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THE SIGNIFICANCE OF CALCIFIED ABDOMINAL LYMPH NODES*

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INTRODUCTION

THE "undiagnosed condition of the abdomen" is a problem frequently encountered by clinicians, the solution of which usually requires the aid of the roentgenologist. The barium meal and enema, cholecystography and films of the urinary tract often give a satisfactory answer. There are many patients, however, with abdominal distress or pain for which no satisfactory explanation can be found in the gall-bladder, gastrointestinal or urinary tracts. That the demonstration of shadows of calcified abdominal lymph nodes may and frequently does furnish the key to the clinical problem is the theme of this paper. At the outset, possibility of the coexistence of disease of other abdominal organs must be emphasized. The importance of the calcified nodes can be determined only by careful clinical as well as roentgenological study.

ORIGIN OF CALCIFIED NODES

That tuberculosis frequently heals by calcification of the involved tissues is well known. Typhoid fever is said to be a rare cause of calcified mesenteric nodes (Bagg). Parasitic infection as a possible etiology has been suggested but, so far as we know, has never been proved. However, it has been commonly accepted that the presence of calcium in lymph nodes means that these structures are or have been involved by a tuberculous process.

LITERATURE

A critical survey of the entire literature on this subject is not possible here but reference to it is necessary in the discussion of certain interesting aspects of the disease.

It has been known for many years that mesenteric lymph nodes may be the site of a tuberculous process (Bier). They are always involved in intestinal tuberculosis. With much greater frequency, however, mesenteric lymph node tuberculosis is found with no evidence of disease of the intestine. It is with this group of cases that we are concerned.

"Primary," "isolated" and "surgical" tuberculosis of the mesenteric lymph nodes have all been used in the literature to denote this condition. None of these terms is applicable to the entire group of cases. The official terminology at the Presbyterian Hospital includes "calcified mesenteric lymph nodes" for clinical diagnosis and for the case in which the usual pathological evidence of tuberculosis is absent after operation or necropsy; "tuber-

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culous mesenteric lymphadenitis" is used for the cases in which this evidence is present. Recognizing that in the vast majority of instances the mesenteric lymph nodes are diseased without involvement of the intestine, it would seem that the simple term "tuberculous mesenteric lymphadenitis" would be sufficient, with the addition of the adjective "calcified" if calcium is present.

1. *Incidence.* The incidence of tuberculous mesenteric lymphadenitis seems to vary markedly in different parts of the world. The most striking example of this variation is Opie's statement that in a series of 93 necropsies on children and 50 on adults in St. Louis in 1917 no cases were found. In contrast, tuberculous abdominal lymph nodes were present in 18 of 66 young British soldiers.

In a study of necropsies upon 7203 children and 7683 adults in Kiel, Hof (1903) found tuberculous mesenteric lymphadenitis, with no evidence of tuberculosis elsewhere in the body, in 1.4 per cent of the children and 0.8 per cent of the adults. This condition was also present in other cases in combination with other forms of the disease, e.g., tuberculosis of the intestines, of the lungs, etc. He did not give the total incidence. He also gives a list of the percentage incidence of tuberculous mesenteric lymphadenitis without demonstrable involvement of other organs as found in necropsies on children showing some form or other of tuberculosis. The list contains reports from 5 observers including himself, but unfortunately he did not give references, making it impossible to check up on the figures. As he gives it, the incidence varies from 1.5 to 11.0 per cent. Hof states that evidence that the intestinal tract was the pathway of infection was present in 25.1 per cent of the tuberculous children and 5.9 per cent of tuberculous adults.

Schloessmann states that Beitzke, in the Berlin Pathological Institute, found 10 instances of tuberculous mesenteric lymphadenitis with no involvement of other organs in 1100 specially examined necropsy cases during a period of nine months, an incidence of 0.9 per cent.

Corner says that Woodhead in Edinburgh (1888) found tuberculous mesenteric lymphadenitis in 78.7 per cent of tuberculous children and in 11 per cent it was the only lesion present. He quotes Coleman (1893) as having found it in 66 per cent and Carr (1894) in 54 per cent of necropsies on tuberculous patients.

Dunham and Smythe (1926) in New Haven, Conn., found roentgen-ray evidence of calcified abdominal nodes in 21, or 17 per cent, of 120 children with positive tuberculin reactions.

Hart and Rabinowitsch observed an increase in the number of cases of so-called isolated tuberculous mesenteric lymphadenitis during the war from an average of 0.8 per cent for the preceding four years, 1910–1913, to an average of 2.59 per cent for the years 1914–1916. In 1916 it was 3.6 per cent. They attribute the increase to defective inspection of cows and to lowered resistance due to food shortage in Germany.

2. *Mechanism of Infection.* To produce an infection of the mesenteric lymph nodes, most observers hold that the infective material must be swallowed. The absence of disease of the intestine itself indicates either that the organism passes through the intact intestinal wall or that a small lesion is formed which heals without leaving a trace. The latter is, of course, difficult to prove. The literature gives many opinions from the clinical and pathological standpoints that the former is true. Furthermore it is supported by considerable experimental evidence.

Schloessmann states that Orth reported some animal feeding experiments performed before the identification of the tubercle bacillus which led him to the conclusion that the "poison" of tuberculosis was of the type which could pass through the intact intestinal wall. Orth believed that a severe generalized tuberculosis could take place through the intestinal route without actual infection of the intestine itself. Such conditions were found in 45 per cent of the experimental animals.

Dobroklonski, in 1890, reported some apparently very carefully controlled work which supports this conclusion. Guinea pigs were fed on glycerine cultures of tubercle bacilli and were killed at intervals

from the fourth to the fortieth day. On the fourth to the sixth day he found evidence of infection of the mesenteric lymph nodes draining the ileum and cecum. At this period he was able to demonstrate the organisms only in these nodes and in the intestinal wall. He saw some bacilli lying between epithelial cells with part of the organism in the intestinal canal. Later Peyer's patches were involved but the intestinal wall remained intact.

Martin (1905) reported feeding experiments with calves and guinea pigs, the result of which varied with the virulence of the organism. When avirulent material was used the following results were obtained: (1) No lesion was produced at the site of invasion. (2) The lymph nodes in connection with one part or another of the intestinal tract became infected. (3) From this focus quite distant parts were in some cases affected, namely the lungs, the pleura or even an organ so remote as the epididymis. Peyer's patches were occasionally involved with no ulceration of the intestine.

3. *Site of the Infected Lymph Nodes.* It has been frequently noted in the literature that the involved nodes are usually situated in the lower part of the mesentery of the small intestine or medial to the cecum and ascending colon. In 15 of the 30 cases reported by Bagg, they were located in the ileocecal angle. In our experience the shadows of calcified nodes usually lie below the third lumbar and above the second sacral segment, on either side of the midline, but more often to the right than to the left. In 23 of 29 unselected cases they were in the right lower quadrant of the abdomen. At operation, in the majority of cases, they are found in the mesentery of the lower loops of the ileum or medial to the ascending colon. This localization is attributed to the normal slowing up of the intestinal contents in the ileum, cecum and ascending colon, which gives the organisms a better opportunity to pass through the wall than elsewhere in the intestinal tract.

4. *Type and Source of Infection.* One fact repeatedly brought out in the literature on this condition is the absence of a history of contact with tuberculosis or what some writers term "hereditary predisposition." It is usually assumed that milk from tuberculous cows is the most frequent source of infection. Hart and Rabinowitsch state that the average figure given as the incidence of the bovine type of tubercle bacillus in mesenteric lymph node tuberculosis is 59 per cent. In 8 consecutive cases in 1916 they found the bovine organisms in 6.

Bier quotes Demme as having reported in 1887 a case from the Children's Hospital in Bern in a four months old infant in which careful examination disclosed no evidence of tuberculosis of the intestine or other organs. He traced the infection to a tuberculous cow, the milk of which had been fed to the infant.

In many cases it is impossible even to guess at a probable source of infection. We have discovered calcified nodes in individuals who have been surrounded by the best hygienic conditions that wealth can provide and who have never been in contact with pulmonary tuberculosis. It seems likely that, as the infection occurs in childhood, milk is the commonest medium.

5. *Pathology.* All stages of the tuberculous process may be found in mesenteric lymph nodes—tubercles, caseation, liquefaction and all degrees of calcification. Opie mentions a caseous node, in the microscopic examination of which no calcium was found. A roentgenogram, however, disclosed a calcareous rim.

The proportion of cases with, to those without, calcification in tuberculous mesenteric nodes cannot be determined from most of the articles in the literature. In Bagg's 30 cases, calcium was present in 13, four of which in adults from eighteen to twenty-four years of age were solidly calcified. Conversely, of 10 cases showing only caseation, 8 were in children and 2 in adults. Apparently the older the individual, the more likely is a tuberculous mesenteric node to contain calcium.

Hanford found calcium present in 58 per cent of cases of tuberculous cervical lymphadenitis.

Along with calcified mesenteric lymph nodes are occasionally found soft nodes which have an abnormal appearance

grossly and in which the pathologist describes a hyperplastic condition which he labels "chronic lymphadenitis." Bagg describes partially caseated nodes, in other portions of which a hyperplastic condition is present. This writer suggests that the tubercle bacillus may remain latent in the node and not produce a typical tuberculous process.

Viable tubercle bacilli in calcified mesenteric nodes are not demonstrated in the majority of our cases by the methods routinely used. Occasionally the guinea pig test is positive.

CLINICAL EVIDENCE OF THE DISEASE

The patients may be any age, but the disease is most often seen in children and young adults. The majority of our cases are between the ages of fifteen and thirty.

The outstanding symptom is pain usually located in the lower part of the abdomen, most often in the right lower quadrant or around the umbilicus. Nineteen of the 23 patients mentioned with shadows of calcified nodes in the right lower quadrant complained of pain in this region. It is sometimes dull and dragging, more often sharp and colicky in character. It is apt to come in attacks which may be extremely severe and which are not infrequently accompanied by nausea and vomiting. It sometimes radiates to the back or to the thigh.

The attacks are likely to be induced by, and the pain is often worse after, anything which lowers the resistance of the patient, as fatigue, nervous strain or the menstrual period in women.

Examination of the abdomen often discloses localized tenderness usually in the right lower quadrant. Sometimes two or three tender points are found. The abdomen is often soft but there may be slight or moderate rigidity during attacks. Rarely, in our experience, a palpable mass is present, although in the literature this is stressed as an important sign.

Fever may be present during the attacks or longer. The white blood cell count is not elevated.

Rarely is there evidence of tuberculosis of the lungs or elsewhere.

COMPLICATIONS

The complications which may follow this disease are four: (1) Adhesions from the involved nodes to the abdominal wall or to the intestine which may produce ileus; (2) pressure upon other structures, e.g., the stomach (Stewart), the ureter (Randall, Bagg) or the mesenteric vessels (Sherman); (3) perforation of a caseous node into the peritoneal cavity (Head, Bagg), and (4) generalized miliary tuberculosis. The symptoms of these complications may entirely mask the original disease.

DIAGNOSIS

In early years the diagnosis was apparently never made before operation or necropsy. Operation was performed for abdominal tumor, appendicitis, intestinal obstruction or because the violence of the symptoms seemed to indicate surgical exploration. Most writers stress the difficulty of making the diagnosis clinically.

The symptoms usually suggest appendicitis, less frequently urinary tract stone, gall-bladder disease, peptic ulcer or some other less common abdominal condition.

Acute appendicitis is occasionally very difficult to rule out. Elevation of the white blood cell count is important evidence in favor of it. Our surgeons feel impelled in occasional instances to operate, knowing that calcified nodes are present, because acute appendicitis may coexist.

Chronic appendicitis is a moot question which we hardly have time to discuss. Suffice it to say that in many of the cases reported in the literature the operation was performed with this diagnosis. Suggestive evidence that the appendix is not the source of the trouble may be obtained by a roentgen study of the gastrointestinal tract. It may be possible to demonstrate that the tender point lies medial to the cecum or appendix or perhaps over the calcified node itself.

The first step in making the diagnosis is, as Geherls puts it, to think of tuberculous mesenteric lymphadenitis. The next step is the elimination of any of the above mentioned conditions which seem to be suggested by the symptoms. Klein thinks

that the tuberculin reaction is a help as it sometimes causes a painful swelling of the involved nodes. The diagnosis, however, must remain a surmise unless a palpable mass is present or calcified nodes can be demonstrated by a roentgenogram of the abdomen.

ROENTGEN-RAY EXAMINATION

Corner, an English surgeon, reported a case operated upon by him in August, 1904. A man, aged forty-one, had pain about the right kidney and various other unrelated symptoms. A roentgenogram showed a shadow opposite the third lumbar vertebra which "might be a renal calculus." It was decided that his troubles were functional and he was discharged. The persistence of the symptoms, however, led to an exploratory operation at which a tuberculous node about the size of a large walnut was found at the site of the roentgen shadow. The caseous material was removed and the walls curetted. The symptoms disappeared after the operation and when seen a year later the patient was perfectly well. As far as we know this is the first case in which a roentgen shadow was proved to be due to a tuberculous abdominal lymph node.

This writer, in 1905, recommended roentgen examination of the abdomen as an aid in the diagnosis of this condition, as did Thiemann in 1910. The other writers of this period apparently ignored it. Later several mentioned it casually. Cabot's Differential Diagnosis, in Chapters IV and V entitled "General Abdominal Pain" and "Epigastric Pain," "tuberculous peritonitis" and "tabes mesenterica" are given as a cause of symptoms. In Chapter VIII, the summary of "Cause of Right Iliac Pain" does not mention tuberculosis though 3 cases of "pericecal tuberculosis" and one of "tabes mesenterica" are included. No mention is made of the possibility of aid from a roentgen examination of the abdomen. Dunham and Smythe in 1926 again emphasized its importance. Due in the first instance to the interest of Dr. Albert R. Lamb and Dr. Hugh Auchincloss, it has been the custom at the Presbyterian Hospital in New York for more than ten years to make systematic use of the roentgenogram of the abdomen in search for calcified nodes.

The shadows of calcified lymph nodes are so familiar that it is hardly necessary to describe them here or to discuss the difference between them and the shadows of urinary tract stones or of calcium-containing gallstones. We have seen instances where the flaky, irregular density of the calcified node was obliterated by slight motion, making it look very much like the homogeneous density of a kidney stone. The node shadow may show the effect of motion, though the sharpness of the kidney outlines and of intestinal gas shadows indicates that no respiratory movement took place during the exposure. Such motion may well be due to peristalsis of the small intestine which might shift the position of a node near the intestinal margin of the mesentery.

Calcified nodes superimposed upon the spine, especially in the lumbosacral region, may be indistinguishable from the shadows of the vertebrae in the usual anteroposterior view. If the symptoms are strongly suggestive and nothing is seen on the usual flat film, it is advisable to take stereos or flat films in both prone and supine positions, as well as a lateral view. The lateral is useful in differentiating a calcified node from a kidney stone in doubtful cases. In one case the shadows of small, sand-like, densely calcified gallstones were erroneously interpreted as a calcified node.

The roentgenogram makes the diagnosis only when calcium is present. We undoubtedly see instances of this disease before calcification takes place, a fact which a reëxamination later may show.

TREATMENT

The treatment of this condition is usually at first hygienic, with rest, relief of strain, avoidance of fatigue, improvement of nutrition, etc. If fever is present the treatment is that of any febrile tuberculosis. Natural or artificial heliotherapy is often used. Roentgen-ray treatment receives both approval (Mittenleiter, Klein, Bell) and disapproval (Bagg) in the literature. We have never tried it. Geherls used tuberculin.

Surgical intervention is indicated when the symptoms are so violent as to suggest a complication such as intestinal obstruction, when the presence of a concomitant acute appendicitis cannot be excluded with reasonable certainty or when the usual symptoms persist in spite of careful hygienic treatment. We are not qualified to discuss the surgical procedure, but wish to point out that the removal of calcified or caseous nodes, when it is possible without injuring the blood supply of the intestine, is strongly indicated, especially those in the ileocecal angle. The appendix, if present, is, of course, removed.

The results of surgical intervention have usually been quite satisfactory, as is evidenced by the case reports in the literature as well as by our experience. And this is in spite of the fact that not infrequently only part of the diseased nodes can be removed. The pain is often immediately relieved; in other cases it recurs with diminishing severity and finally disappears. Continuation of postoperative hygienic treatment is highly advisable, especially if some of the involved nodes could not be removed at operation.

MECHANISM OF PAIN PRODUCTION

The mechanism of the production of symptoms by tuberculous mesenteric lymphadenitis, in the absence of the previously mentioned complications, is not clear. It should be emphasized that a solidly calcified node seems to be just as able to produce pain as uncalcified, actively diseased nodes.

Inflammatory irritation of the peritoneum is mentioned by Schloessmann as a factor in some cases and an example is given by Davidović. It would not be expected with well calcified nodes. The operative notes on some of our cases mention the presence of dilated blood vessels in the peritoneum over the calcified nodes, suggesting the effect of peritoneal irritation, possibly mechanical.

The sympathetic nerves, according to Starling, are vasoconstrictor and probably vasodilator for the stomach and small intestine, inhibitory for both muscle coats of the stomach and small intestine and motor for the ileocolic sphincter. The vagus is motor for the stomach and small intestine as far as the ileocolic sphincter. Mechanical irritation of these nerve fibers in the mesentery may produce symptoms by reflexly interfering with peristalsis or vasomotor tone, or by lowering the threshold so that the pull of over-active peristalsis on the mesentery may cause pain. Of interest in this connection is the striking part played by fatigue and nervous strain in the precipitation or aggravation of the symptoms. Klein suggests that an inflammatory or cicatricial process about the diseased node may actually involve the nerve fibers. Kantor states that the involvement of nerve trunks in adhesions may give rise to disordered visceral physiology, and gives two illustrative cases. Schloessmann believes that the relief of pain following operation is due to the severing of these nerve fibers and to the reduction of tension on the peritoneum. The colicky nature of the pain indicates that the physiology of the intestine is abnormal, but the exact mechanism remains obscure.

CASE REPORTS

It is not the purpose here to present a clinical study of a large series or to attempt to discuss the difficulties of diagnosis from the clinical standpoint. We wish, however, to present a few illustrative cases.

Case I (Unit No. 73149, Necropsy No. 9873). A child aged two, was admitted to the hospital with clinical evidence of tuberculous meningitis of which he died. At necropsy, rather extensive tuberculosis of the mesenteric lymph nodes was found. The pathologist discovered that the wall of the mesenteric artery was involved and that the artery was thrombosed. In the thrombus, acid-fast bacilli were demonstrated. He considered this the origin of the generalized miliary tuberculosis of which the meningitis was the outstanding clinical manifestation.

Case II (Fig. 1). The thirteen year old son of a member of our surgical staff is considerably below the average in height. He is perfectly well and is very bright mentally. In the attempt to find any possible physical basis for his failure to grow at the usual rate, the presence of calcified abdominal nodes was discovered. He has never had any symptoms

which might be attributed to them. He has had no exposure to pulmonary tuberculosis. At home he always received Walker-Gordon milk. His oldest sister, who is now about nineteen, has calcified abdominal nodes without symptoms. Four years ago, however, she had an acute appendicitis and appendectomy. This case emphasizes the fact that nodes do not always cause symptoms and that it may be difficult to trace the source of infection.

Fig. 1. Case II. A calcified node lies just below the right transverse process of the fourth lumbar vertebra and another over the second sacral segment. This patient had no abdominal symptoms.

Fig. 2. Case III. Two or three calcified nodes partially overlie the left side of the fourth lumbar vertebra. This boy had prolonged, recurrent, low fever suggesting an active tuberculous mesenteric lymphadenitis.

Case III (Unit No. 31951. Fig. 2). The eight year old son of a member of our medical staff had always been well except for a tendency to frequent colds. He had always been given Walker-Gordon milk. There was no family history of pulmonary tuberculosis. His mother, who had an appendectomy in 1918, following an acute attack of abdominal pain with fever suggesting gall-bladder disease, was found to have calcified abdominal nodes. Her cholecystograms were normal. A second less severe attack occurred six months after the first.

The boy had a cold in March, 1926, following which his temperature did not return to normal. During the following two years it ranged from normal to 100° in the morning and to 101.5° in the evening. During this time he had four attacks of acute abdominal pain and gastric retention relieved by vomiting. Activity, school and the winter months increased the fever. He was improved by rest in bed, by life at the seashore and by tanning.

At the onset in March, 1926, films of the chest disclosed no evidence of tuberculosis and his lungs have remained clear, both clinically and roentgenologically. Films of the abdomen disclosed two or three calcified nodes.

The tuberculin test was very strongly positive. The area of reddening was 8 cm. in diameter.

The calcified abdominal nodes were considered evidence of a more extensive and active tuberculosis of the mesenteric lymph nodes. In spite of excellent hygienic treatment he continued to run this fever for two years, when his father decided to send him to Rollier's clinic in Switzerland. Ten days after beginning treatment there his temperature became normal and his improvement has been uninterrupted.

Case IV (Unit No. 55945. Figs. 3 and 4). A girl, aged twenty-two, came to Dr. Albert Lamb in 1922 complaining of pain in the abdomen. There was a questionable family history of tuberculosis and one sister had swollen cervical nodes. At the age of eleven

she began to have fainting spells which disappeared after two years in California. With onset of the menses at the age of fifteen, she began to have dysmenorrhea. At seventeen an attack of abdominal pain was so severe that a diagnosis of appendicitis was made by an excellent surgeon, and a normal appendix was removed. At nineteen, retroversion of the uterus was discovered and three years later a ventral suspension was done. Later that same year a London physician told her she had gall-bladder disease.

She had two kinds of pain. The first began in 1920, when she was awakened one night by severe pain in the epigastrium and under the right costal margin, lasting several hours. During the succeeding two years she had other less severe attacks.

The second type of pain was located in the right lower quadrant radiating around the ilium and down the right thigh. This she had had for several years. It appeared at intervals during the week before menstruation began, was very severe the first day of the period and then gradually disappeared. It was worse when she was fatigued and was less severe when she was rested and had gained weight.

Physical examination disclosed nothing of importance except tenderness in the right lower quadrant.

Calcified nodes were demonstrated in the right lower quadrant by Dr. Imboden in 1922. A little later she was examined roentgenoscopically at the Presbyterian Hospital; the node shadows were found to be movable and the tenderness definitely localized over them.

Fig. 3. Case IV. Calcified nodes lying on the right of the fifth lumbar vertebra were apparently associated with attacks of violent right lower quadrant pain. The pain disappeared after removal of the nodes.

Fig. 4. Case IV. This film shows the relation between the calcified nodes in Figure 3 and the ascending colon. At operation they lay in the ileocecal angle.

In February, 1923, the right lower quadrant pain recurred in frequent severe, colicky attacks, radiating to the back and to the right upper quadrant lasting fifteen to thirty minutes and disappearing as suddenly as it came. This continued for about two months.

At operation in April, 1923, Dr. Hugh Auchincloss found a mass of calcified nodes in the ileocecal angle about 3 cm. above the ileum and medial to the ascending colon, and lying in intimate contact with a mesenteric vein. Near the mesenteric root were four discrete uncalcified nodes, in one of which was a yellowish white area suggesting caseation. They and the calcified nodes were removed. Microscopic examination of the soft nodes showed hyperplasia but no evidence of tuberculosis. The pathologist interpreted the calcified nodes as healed tuberculous mesenteric lymphadenitis. Culture and guinea pig inoculation were both negative.

Since operation she has had no more right

lower quadrant pain and has had an uneventful pregnancy.

Case v (Unit No. 71319. Fig. 5). A girl, aged eighteen, came to Dr. Hugh Auchincloss in 1923 complaining of dysmenorrhea and acne. He found tender points at the umbilicus and below it on both sides. He thought of the possibility of calcified mesenteric nodes but the roentgenogram showed no evidence of them.

Fig. 5. Case v. Several faintly calcified nodes lie along the right side of the lower lumbar vertebrae. At operation several partially calcified nodes were found in the ileocecal angle. They were not visible on a film taken five years previously when symptoms began.

In June, 1926, she had pain in the right lower quadrant which was not severe and which lasted only a couple of days. It was present when she was active and disappeared when she was quiet.

During 1927 she had several attacks of dull, not very severe right lower quadrant pain with menstrual periods but which was entirely different from menstrual pain.

In April, 1928, while at college she had a between period attack of this same pain, without fever, nausea or vomiting, which lasted the entire day. It improved with rest. She went to classes the next day but the pain returned in the afternoon. She had it again the third day, associated with generalized malaise and discomfort. She was observed in the college infirmary for several days where her temperature was never above 99.2° and the white blood cell count ranged between 5000 and 8000. Appendicitis was suspected but the diagnosis was not clear. On the fourth and fifth days the pain was noticeable only on motion but the malaise continued. She was admitted to the Presbyterian Hospital on

Fig. 6. Case vi. A calcified node overlies the right margin of the fifth lumbar vertebra. Two others are seen at the left of the second and third lumbar vertebrae. A long series of attacks of right lower quadrant pain was interrupted by removal of the lower node which contained viable tubercle bacilli.

May 1. A film of the abdomen disclosed several rather faint shadows along the right side of the spine which looked like calcified nodes.

Operation was performed May 2 by Dr. Hugh Auchincloss. The appendix appeared perfectly normal but was removed. Several partially calcified lymph nodes lay in the ileocecal angle and one just below it. Several soft hyperplastic lymph nodes showing no evidence of tuberculosis were present in the mesentery draining the ileum. The pathologist found nothing abnormal in the appendix. Some of the lymph nodes contained rather cheesy calcified material. Microscopic examination disclosed abnormal cellular changes but nothing characteristic of active tuberculosis. Guinea pig inoculation was negative. No follow-up report on this case is available at this time.

Case vi (Unit No. 70419. Fig. 6). A girl, aged seventeen, a private patient of Dr.

Albert Lamb, was admitted to the Presbyterian Hospital, Dec. 4, 1927. She had a history of a long series of attacks of pain in the right lower quadrant suggesting appendicitis. A roentgenogram of the abdomen disclosed calcified nodes in the right lower quadrant.

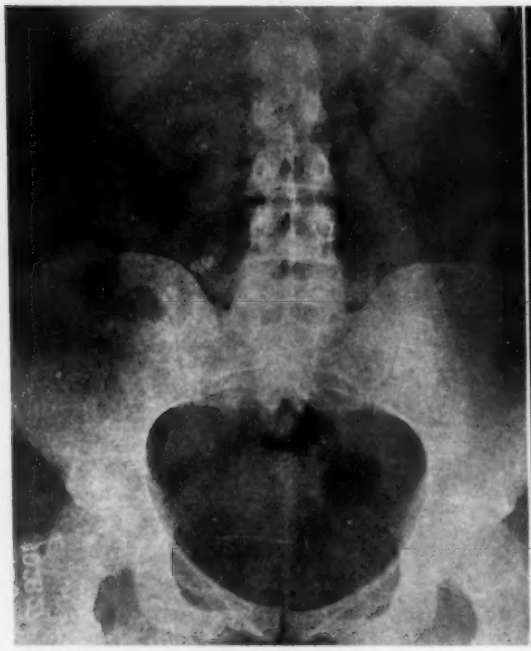

Fig. 7. Case vii. Calcified nodes beneath the parietal peritoneum in the angle between the ascending and the transverse colon were associated with adhesions to the adjacent large intestine causing partial ileus.

Fig. 8. Case viii. Over the left margin of the fifth lumbar and the first sacral segment is the shadow of a calcified node which was not detected. Recurrent symptoms after the removal of an acutely inflamed appendix led to an exploratory operation at which the caseous and calcified node was found in the left leaf of the mesentery. The symptoms have not recurred since the removal of the node.

Operation was performed by Dr. Hugh Auchincloss on Dec. 5. The appendix contained fecal masses but was called normal by the pathologist. Along the vessels running to the ileocecal region close to the base of the mesentery was a partially calcified lymph node about 2.5 cm. in length which was full of whitish caseous and calcareous material.

Microscopic examination showed small masses of lymphoid tissue in the node with some connective tissue and a large amount of caseous matter. No tubercles or giant cells were seen. Guinea pig injection showed tubercle bacilli to be present.

Up to June, 1928, she had had no recurrence of the abdominal pain.

Case vii (Unit No. 54290. Fig. 7). A young woman, aged twenty-two, came to the emergency ward of the Presbyterian Hospital, June 5, 1922, complaining of pain in the right lower quadrant which had been coming in attacks of increasing frequency during the previous year. At times it radiated to the back and down towards the pubis. The attack at the time of admission had lasted eight days and was associated with fever but not with vomiting. Her temperature was 100.4° and the pulse rate 100. The white blood cell count was 5900, polymorphonuclear leucocytes 49 per cent. The urine was negative. Physical examination disclosed nothing abnormal. A roentgenogram of the abdomen showed the presence of calcified nodes in the right lower quadrant.

After five days of observation in the hospital, during which time her temperature became normal and the pain disappeared, she was discharged.

She then began to have almost constant dragging pain in the right lower quadrant, made worse by running and even by stretching out in bed. She got some relief by flexing the thighs. An indefinite small mass was found in the region of the cecum and she was readmitted to the hospital. Operation, June 26, 1922, by Dr. Auchincloss, disclosed a somewhat clubbed but essentially normal appendix.

Beneath the parietal peritoneum in the angle between the ascending and transverse colon were several firmly calcified lymph nodes. Extending from these nodes to the ascending and to the first part of the transverse colon were peritoneal adhesions which were attached in such a manner as to roll the colon over. It looked as though this rotation of the gut might well interfere with its function. It seemed to the surgeons that these adhesions were unquestionably the source of her symptoms. They were severed, leaving the colon free, and the appendix was removed. The calcified nodes extended so far backward toward the celiac axis that it was inadvisable to attempt to remove any of them.

Because of some cellular changes the pathologist made a diagnosis of chronic appendicitis.

Since discharge the patient has been seen every few months. She was given dietary and hygienic treatment. For about two years she continued to have a little colicky right lower quadrant pain. She gained weight, however, and the pain gradually diminished and finally disappeared. She has been symptom-free for approximately the past four years.

Case viii (Unit No. 61625. Fig. 8). A woman, aged twenty-six, who had occasional right lower quadrant pain following the lifting of a heavy weight two years previously, came to the emergency ward of the Presbyterian Hospital, Dec. 12, 1924, complaining of severe sharp abdominal pain of fourteen hours' duration. The pain was generalized at first but later localized in the right lower quadrant. The temperature and the white blood cell count were elevated. An acutely inflamed appendix with acute local peritonitis was found at operation.

Two months after discharge from the hospital the patient again complained of pain in the lower part of the abdomen to the right of the midline which was aggravated by exertion and menstruation and which interfered with her work as a housemaid. At times it amounted only to discomfort. She was running an afternoon temperature of 100° by mouth. The white count was normal. There was deep tenderness over the lower part of the right rectus.

The pain continued and she was readmitted for study five months after the operation. While in the hospital a small, oval, very tender, slightly movable mass was felt just below the umbilicus and a little to the left of the midline.

The roentgenogram of the abdomen was thought to be negative. In spite of this the surgeons felt that she probably had tuberculous mesenteric lymphadenitis. Operation was performed on June 10, 1925, by Dr. Frank Meleney. Protruding from the left leaf of the mesentery and overlying the aorta was a hemispherical mass about 3 cm. in diameter. It contained yellow caseous material. Where it was attached to the deep tissues, plaques of calcium were found. It was in contact with one large branch of the mesenteric artery. On its surface were a number of dilated blood vessels. It was removed.

The pathologist described it as an egg-shaped piece of tissue $3.5 \times 2.5 \times 2$ cm. On section it was found to be composed of cheesy material containing calcium, inside a harder shell.

The patient was discharged, June 29, 1925. Since then she has been seen every few months and has had no return of the abdominal symptoms.

The shadow of this calcified node on the film is visible if one looks in exactly the right spot. It is very difficult to see and was overlooked by a number of observers.

COMMENT

Case i illustrates one of the complications of tuberculous mesenteric lymphadenitis—generalized miliary tuberculosis. Calcified mensenteric nodes were present in Case ii without symptoms. The demonstration of calcified abdominal nodes in Case iii suggested an associated active tuberculous mesenteric lymphadenitis as an explanation for the patient's long-continued fever. In Case iv, calcified mesenteric nodes were apparently responsible for severe recurrent abdominal symptoms which had previously led to appendectomy, uterine suspension and a diagnosis of gall-bladder disease. The symptoms in Case v caused Dr. Auchincloss to suspect calcified mesenteric nodes five years before they were actually demonstrated. This case also illustrates the difficulty in ruling out acute appendicitis. In Case vi the symptoms suggested appendicitis and the calcified node contained viable tubercle bacilli. Case vii is an example of another complication—adhesions to a viscus which were apparently responsible for severe recurring abdominal pain. Although the adhesions were severed and the gut freed, the calcified nodes could not be removed. The relatively moderate pain which continued after the

operation was relieved only after two years of hygienic treatment. Acute appendicitis with localized peritonitis and operation was followed in Case VIII by recurrent abdominal pain which suggested tuberculous mesenteric lymphadenitis clinically. In spite of an apparently negative roentgen-ray examination, the clinical diagnosis was confirmed at operation and the symptoms relieved by removal of the caseo-calcareous node. This case illustrates the occasional difficulty in detecting a calcified node on the roentgenogram when it is superimposed upon the spine.

These cases have been selected to illustrate certain points in connection with this condition. It must be emphasized that the clinical importance of calcified abdominal nodes is not always so definite and that their presence is not ipso facto an indication for operation. Ignoring them, however, may lead to erroneous diagnoses and hasty operations, whereas correct evaluation of their importance will result in surgical procedures, if at all, only after long continued skillful hygienic management has failed to produce satisfactory results.

SUMMARY

Tuberculosis of mesenteric lymph nodes has not infrequently been found, with no evidence of tuberculosis of the lungs or intestines at necropsy (tuberculous mesenteric lymphadenitis). The incidence of this disease apparently varies greatly in different parts of the world. Pathological and experimental evidence suggests that the bacilli may pass through the intact intestinal wall into the lymphatics. Those which drain the ileum, cecum, appendix and proximal part of the ascending colon are the most frequently involved. Calcium may be deposited in caseous nodes containing viable organisms and completely calcified nodes may be present alone or in association with actively diseased nodes. This disease may be responsible for unexplained fever and for abdominal symptoms in adults as well as in children. These symptoms may manifest themselves as obscure, indefinite pain suggesting other abdominal conditions, or as severe sharp attacks which not infrequently suggest acute appendicitis. The preoperative diagnosis can usually be made with certainty only by the demonstration of typical calcified nodes on the roentgenogram. Where hygienic treatment has proved unsatisfactory, a surgical attack on the disease has been followed by relief of symptoms.

Calcified mesenteric lymph nodes may be innocuous or may coexist with other abdominal diseases, but their shadows on the roentgenogram frequently offer a solution for an otherwise puzzling clinical problem.

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ACTIVATED ERGOSTEROL IN RADIATION SICKNESS

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RADIATION sickness has remained one of the problems in the field of radium and roentgen therapy, in spite of the great amount of clinical and experimental work that has been done upon the physical, chemical and biological aspects. The number and diversity of treatments recommended have argued for multiplicity of factors entering into the clinical reactions so commonly seen after irradiation. The present communication is a report dealing with clinical observations and tests which may possibly better correlate these apparently diverse aspects.

For the sake of clarity, let us outline the clinical picture. The reaction experienced may be (1) immediate, consisting of malaise, loss of appetite, headache, vomiting, fever, diarrhea or acute prostration, or (2) late, with nausea, abdominal pain and distention, fever, diarrhea, general weakness and fatigability or even cachexia. These may occur in any combination. As is known to every radiologist, the immediate symptoms are more pronounced when the abdomen, and particularly the upper abdomen, is within the field of the rays. The present consideration is largely limited to the acute disturbances, with particular regard to their prevention, mitigation or relief.

The various theories which have been advanced to account for the acute manifestations will not be discussed in detail here. In the more recent English and American literature these have been summarized by Rolleston,[18] Schmitz,[19] Doub, Bolliger and Hartman,[6] and Hirsch.[9] The conceptions prevailing at the present time are that the cause is: a toxemia from broken-down proteins or lecithin-lipoids;[17] a decrease in the cholesterol content of the blood;[1] a shift of the body chlorides;[14] an alkalosis;[6,23] an increased vagus

tonus.[4,5,10,16,21] For discussions of these hypotheses the reader is referred to the abundant literature dealing with exhaustive and often contradictory experimental and clinical findings.

In many instances the symptoms are much lessened if the patient takes complete rest for several hours after each treatment. From the practical standpoint of relief for the patient, until recent experiments, nothing else has given the results that have been obtained with calcium medication as suggested by Kohlmann and Andersen, and Doub, Bolliger and Hartman. However, with the hospital patient the frequent repetition of intravenous injections of calcium lactate is inconvenient at best and with the ambulatory patient it is usually impractical. The oral administration is not very satisfactory. General experience with calcium therapy has left much to be desired, inasmuch as any rise in the blood calcium produced even by intravenous injection is evanescent.

In considering the matter of influencing the body calcium the idea occurred to us that a more effective method than the simple administration of calcium salts would be to give activated ergosterol orally before and during the period of irradiation. It has been found that such a preparation is a most efficient means of increasing blood calcium. Very recently it has been called to our attention that probably the most effective part of its action lies in altering the calcium-phosphorus ratio in the blood. Whether it would act quickly enough to serve as a "stabilizer" of the blood chemistry, so to speak, remained to be seen, as the literature contains no work which might apply in this regard. We are informed, however, that effects upon the blood chemistry are detectable within one or two days after its ingestion.[3]

Although both ergosterol and radiation treatment raise the inorganic phosphorus in the blood,[6,8,12] this did not apparently need to be considered a contraindication to such use of ergosterol, as the phosphorus increase after irradiation is apparently not a toxic factor in itself but only the index of nuclear destruction. It was therefore given to all our patients taking such filtered roentgen treatments as might be expected to produce constitutional symptoms.*

Most of these patients at first received this medication after the first day's fraction of the dose of radiation had been given and many of these temporarily experienced the radiation reaction, though possibly of less than usual severity, after which there was a noticeable lack of such symptoms. When the ergosterol was begun twelve to twenty-four hours before any roentgen-ray treatment was applied the results were markedly improved. Feeling that for these purposes an increase over the ordinary dosage should be made, we raised this to 4 minims twice a day for the adult, making an equivalent of 12 teaspoonfuls of cod-liver oil per day in vitamin D content. When symptoms have threatened in spite of the routine prophylaxis as described, a dosage of 8 minims three times a day has occasionally been ordered with apparent benefit. As a rule the ergosterol is discontinued twelve to twenty-four hours after completion of the roentgen treatment. Ordinarily in the absence of contraindications huge doses are required to produce deleterious effects.[22] Recent work of others, as yet unpublished, has shown that the dangers of overdosage of vitamin D have been much overrated.[3] It would seem that the dosage used is close to the lower limit of that which may be expected to be efficient for this purpose and probably larger doses will be found to be more effective. As there is known to be an increase in the calcium elimination as a result of radium or roentgen treatment, we have ordinarily also prescribed calcium lactate orally (10 grains three times a day) in order to insure an abundant supply of calcium, though we are not as yet convinced of any additional advantage from its use. The patient is encouraged to take complete rest, for four hours if possible, immediately upon return to his room after each office visit.

Fifty-five cases in which the ergosterol

* The product used was "Acterol," a solution of ergosterol in peanut oil, having one hundred times the antirachitic potency (i.e., the vitamin D content) of good cod-liver oil. Mead, Johnson & Co., of Evansville, Indiana, have very kindly supplied us freely with the material for the purposes of this work, since it is not on the market at the present time. We are informed that it will probably be available commercially about August, 1929. Indebtedness to this company's research staff, particularly to Mr. E. M. Johnson, Jr., Dr. C. E. Bills, and Mr. W. M. Cox, Jr., for helpful information is hereby acknowledged.

treatment was used have been observed and certain conclusions have been reached regarding the benefits and limitations of the method. For the purposes of study these cases may be divided into the following groups:

1. Patients previously nauseated by irradiation, but experiencing no nausea after ergosterol (17 cases). This group is made up of patients known to be sensitive to the rays. Depending upon the time relation between the determination of this sensitivity and of the ergosterol effect, they might be further divided into two subgroups: (*a*) those nauseated at a series prior to these tests, but free from nausea when given ergosterol with irradiation (8 cases), and (*b*) those nauseated at the first series and treated with ergosterol shortly after onset of nausea (9 cases).

In subgroup (*a*) the patients experienced very marked relief. One of these has a sarcoma of the ovary which has required roentgen treatment at intervals during the past three and one-half years. Each treatment series produced marked nausea until ergosterol was used, when there were practically no symptoms and the appetite was enormously increased. One woman who had several times previously been much distressed by radiation nausea, a part of which occurred during her period of hay-fever asthma, obtained complete relief from nausea by ergosterol except for a slight uneasiness, evidently of psychic origin, upon entering the therapy room.

In subgroup (*b*) there were 3 patients who while undergoing intra-uterine radium treatment had been quite nauseated for twenty-four to thirty hours before the ergosterol was given, after which nausea was completely relieved within three to five hours, followed by return of good appetite.

An interesting proof of the effectiveness of the method was encountered when upon beginning with a new shipment of the preparation 3 of the patients under treatment, all of them pelvic cases, suffered acute radiation sickness and thus gave clinical evidence that for some reason the potency of the product was below normal. Administration of a fresh preparation at once corrected the condition in all three and they completed the series with the excellent appetite and feeling of general well-being commonly observed with the method. Biological tests showed that the potency of the former shipment was only 25 per cent of normal in antirachitic action. The same result occurred later with another shipment which was afterwards found to be only 50 per cent potent.*

2. Patients not previously irradiated and who experienced no nausea during radiation treatment after ergosterol (29 cases). Since this group comprises a little more than half of the entire series, it compares more than favorably with our usual experience previous to these tests, particularly since with many of these the roentgen dosage per day was increased 50 per cent or more over the amount usually given without ergosterol treatment. Furthermore, many of this group refused to rest as directed. Appetite varied from fair to excellent.

3. Patients nauseated though taking ergosterol (10 cases). Analysis of this group was even more encouraging than were the impressions gained from daily observation. Any patient showing appreciable nausea or any vomiting whatsoever was placed in this group if ergosterol had been given as much as twelve hours before the illness. Only 4 of this group were much nauseated and of the four one had a very large recurrent pelvic tumor of teratoid type and one had extensive metastatic mediastinal malignancy. The nature and duration of symptoms in the latter indicate that they were probably due primarily to the malignancy, as she had been placed in Group 1*a* before the extension to the mediastinum had occurred. One other who began the ergosterol and the irradiation simultaneously attributed her nausea to the former and completed the series without the medication. One reacting patient is omitted here because her symptoms and subsequent course have indicated that there is a pelvic infection. Another of

* We are informed by the manufacturers of the product that this is the first time that there has come to their attention such an apparent loss in strength without undue exposure to air and chemicals. They found that after the biological standardization the preparation had been exposed to extreme cold which had left the supernatant oil unduly weak in ergosterol. It should be stated that up to the present time only small quantities have been made up for experimental purposes. The larger quantities now being made and the biological tests and the safe-guards now in use will obviate these possibilities of under-dosage.

these patients, who has a very large, persistently recurring ovarian tumor, had much less diarrhea and post-irradiation prostration than with previous treatments. Another patient who had a very large sarcoma in the scapular area is included here because she vomited once at the close of the series. The others had only slight disturbance. Four of these were in a generally depressed condition from various causes.

4. Patients suffering from colon irritability (7 cases). Each of these is included in some one of the preceding groups, distributed as follows: Group 1*a*, one case; 1*b*, one case, (probably an infectious diarrhea); 2, four cases; 3, one case. Of those in Group 2, diarrhea in one was undoubtedly due to impending obstruction of the bowel. There was much epidemic diarrhea in the community during the course of these experiments, which has prevented our drawing as accurate conclusions regarding influence upon bowel symptoms as might otherwise have been obtained. All of this group received roentgen radiation over the lower abdomen and pelvis. Three of them had been on medical management for "irritable colon," before beginning treatment with roentgen radiation. In all of them acute bowel symptoms were readily controlled by opium medication so that the roentgen treatment could be continued.

In general the appetite is much better than is the case without such prophylaxis and in some it has been greatly increased over the normal even for a period after irradiation has been completed, making the method valuable in many instances for this action alone. A few patients have spoken of a feeling of general stimulation during and after a treatment series. In general, the well-tolerated roentgen dosage per day has been increased in all areas and in all conditions which have been treated. There has been a marked decrease in the malaise and general lack of nervetone so often experienced during roentgen treatments. There are still patients who exhibit these symptoms but the percentage is much lower than we have previously observed and the illness is relatively slight. Perhaps these patients should have a longer period of preparation or larger dosage of ergosterol. A study of the blood chemistry in this group will possibly give further information. In one recent case of this group we have seen prompt relief follow the administration of cholesterol after the method of Burgheim.[1] This investigator has found a considerable decrease in the cholesterol content of the blood of patients particularly affected by irradiation, in which he is at variance with Mattick and Buchwald.[15]

There is no conclusive evidence that any influence has been exerted upon the later phases of constitutional reactions, though there has been but little of the late general physical depression occasionally seen after heavy dosage upon the abdomen or chest.

As yet we have only a theoretical explanation for the results obtained. Search of the literature shows that there has been very little clinical application or laboratory investigations made using ergosterol in the human adult. Some good results have been obtained in tetany thyreopriva and osteomalacia.[12,20] Some reports have been made upon the blood chemistry of the adult.[11] A great amount of work has been done upon infants and animals. Hess and Lewis[8] believe the action is primarily upon the parathyroids. Such an action might explain the surprisingly prompt effects obtained in the condition under discussion.

It should be mentioned here that cod-liver oil has been recommended as a preventive measure against radiation sickness,[7] and Ernst and his coworkers[2] have shown experimentally that rats fed upon a diet relatively rich in cod-liver oil tolerate roentgen treatment much better than do those receiving no such vitamins. Probably the same effect in intensified degree is produced by the activated preparation.

Blood chemistry studies have not yet been pursued far enough to enable us to theorize upon the biochemical action giving this effect in roentgen sickness. Several chemists we have consulted who are familiar with the changes induced by this new and potent medicament in other conditions are likewise at a loss for an explanation of the results observed. It was

on the basis of the known effects of calcium administration and the recognized influence of activated ergosterol upon the calcium metabolism that these clinical tests were made. Lasch[12] has shown that in adults ergosterol increases the blood calcium and cholesterin. Burgheim[1] believes that the calcium disturbances are the result of the cholesterin decrease and that the calcium therapy is only an attempt to remedy damage already done.

There is evidence adduced by Opitz[16] and by Strauss and Rother[21] to the effect that roentgen irradiation produces an increased excitability of the vagus. Löning[13] summarizes some of the literature treating of the relief of vagotonia by calcium medication or ultraviolet radiation. The known similarity of the physiological effects of ultraviolet radiation and activated ergosterol makes Löning's reference seem very significant in the present connection. Furthermore, there are many aspects of radiation sickness which strongly resemble a vagotonia of exaggerated degree. It is also recalled that the former rarely occurs unless some portion of the vagus is within the field of the rays. Löning further calls attention to the frequent association of heightened vagus tonus with corresponding weakness or fatigability of the sympathico-adrenal system, particularly in those patients with a tendency to spasm of the smooth-muscle viscera considered in its broadest sense. In all these spasmogenic diatheses there is frequently a disturbed potassium-phosphorus-calcium relation and a tendency to vagus hypoglycemia. It seems more than a coincidence that such widely different substances as calcium, glucose and adrenalin[4] have been individually recommended as efficient in the prevention and treatment of radiation sickness when they are regarded as having the relations noted above. When penetrating roentgen radiation is applied over the abdomen there occasionally occurs considerable diarrhea after only small dosage. It would seem that this must be due to some disturbance in innervation rather than to direct irritation of the mucosa. Roentgen workers show some tendency to these same symptoms, i.e., a vagotonia, and in a rather limited experience we have seen them markedly relieved under treatment with ergosterol. A typical case of vagotonia which had never been exposed to such irradiation showed similar marked improvement under the same treatment.

These facts have led us to believe, pending further investigations, that the favorable effect of activated ergosterol in radiation sickness may be exerted through alterations in the calcium-phosphorus content and equilibrium in the blood and that this reacts ultimately upon the vagus. An interesting field of study is here opened, not only for the roentgenologist, but for the internist. Proof of the relation of vagotonia to radiation sickness must, however, await further evidence.

SUMMARY

1. The clinical results of the oral administration of activated ergosterol in early radiation sickness is described. This use has not been found mentioned in the literature.

2. Marked relief of all symptoms is usually effected, except possibly diarrhea. Used as a prophylactic, ergosterol prevents all symptoms to a marked degree. These results apparently occur in both radium and roentgen treatment.

3. Many of the patients experience an unusual sense of well-being and increased appetite.

4. The action is probably effected in some way through the calcium-phosphorus metabolism. There is some evidence that the final effect may be brought about through prevention or reduction of hyperirritability of the vagus.

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ETIOLOGY OF THE ILL-HEALTH IN CHILDREN BORN AFTER MATERNAL PELVIC IRRADIATION

PART II. DEFECTIVE CHILDREN BORN AFTER POSTCONCEPTION PELVIC IRRADIATION

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IN Part I of this study the etiology of the ill-health of a group of children born after *preconception* pelvic irradiation was investigated.[41] An attempt was made to determine the various causes of health disturbances observed in those children, and especially to ascertain if any of the abnormalities were due to the radiation treatment of the mothers. Sufficient evidence was not gained, however, to justify a conclusion that the children suffered because of the previous maternal irradiation.

It has been previously observed[39,40,41] that 75 children were born of 106 women irradiated during pregnancy. Of these children, 38 (50.7 per cent) were unhealthy and 37 (49.3 per cent) were healthy, indicating that *postconception* irradiation was extremely likely to result in the birth of unhealthy children. A detailed study of the many factors which might have had a bearing upon the ill-health could not be satisfactorily made because of insufficient information concerning the children and their mothers. Since that time, however, we have been able to secure complementary data through personal communications from the authors who had observed such cases.

The present paper deals with the 38 unhealthy children who were exposed, *in utero*, to irradiation during treatment of the mothers. Its purpose is to disclose the various conditions bearing upon the poor health of these children and, particularly, the extent of the influence of irradiation.

Throughout this study the words

"*unhealthy*" and "*defective*" have been employed interchangeably in referring to the children irradiated *in utero*, who were considered to be in any way abnormal. Any child was considered to be unhealthy or defective who was still-born or born prematurely, or was subnormal or deformed at birth, or who later presented any pathological condition whatsoever, or who had died prior to the time of this report.

We have been able to determine the causative factors of the ill-health in a number of children with the aid of the additional data recently secured from the various authors. Throughout this study, the ill-health or defects in the children were considered as due to those factors which seemed to have the least bearing upon the conditions in question. This was done in order not to favor the irradiation as an etiological factor.

The 38 unhealthy or defective children born after postconception pelvic radium or roentgen irradiation have, for discussion, been divided into two groups, according to the nature of the etiological factors which, seemingly, played the most important rôle. The first group includes 10 childern whose ill-health has been ascribed to parental or environmental influences. We have been unable to discover any essential etiological factor (other than the fetal irradiation) to account for the defects observed in the 28 children of the second group.

UNHEALTHY CHILDREN WHOSE ILL-HEALTH MAY BE ATTRIBUTED TO CAUSES OTHER THAN IRRADIATION

A. *Factors Effective before Birth*

Maternal Health Prior to Irradiation. Information concerning the maternal health prior to conception was available in only 10 cases. The maternal general health was good in 3, while some general pathological condition was present in the other 7 (Table 1).

Two women were syphilitic. They gave birth to still-born children who were probably both syphilitic.[12a,12b]

One woman, suffering from pulmonary tuberculosis, gave birth to a microcephalic idiot.[13] The father of this child was a chronic alcoholic. Brousseau[37] states in a recent publication that tuberculosis and alcoholism may be contributory agents in the production of mental defects in children, but that they are not in themselves essential etiological factors. This case of microcephalic idiocy has been attributed to parental ill-health because of the possible relation of the tuberculosis and the alcoholism. It is our belief, however, that the irradiation of the fetus *in utero* may have been the direct and sole causative factor.

TABLE 1

CORRELATION OF MATERNAL ILL-HEALTH WITH ILL-HEALTH OF CHILDREN

Case Number	Health Disturbance of Mother	Condition of Child	Reference
1	Syphilis (husband also syphilitic)	*Still-born	12b[1]
2	Syphilis (husband also syphilitic)	*Still-born	12a
3	Pulmonary tuberculosis (husband suffered from alcoholism)	*Microcephalic idiot	13
4	Cholecystitis (husband tuberculous)	Microcephalic idiot	15
5	"Delicate constitution"	Microcephalic idiot	1
6	Cretinism in childhood	Still-born hydrocephalic child	25
7	Glioma of spinal cord	Spina bifida and club-feet	4

[1] Small letters a and b refer to the child in cases where the author reports births of 2 defective children irradiated *in utero*.

Showing the disturbances in the health of 7 mothers, irradiated during pregnancy, who gave birth to unhealthy children. The children marked with an asterisk (*) may have suffered because of parental ill-health, whereas the ill-health of the remaining children is believed not to have been influenced by the maternal ill-health.

The systemic poor health of the remaining 4 women (Table 1) probably did not play any rôle in the production of the serious developmental disturbances exhibited by the children.

Maternal Age at Time of Conception. The mothers giving birth to defective or unhealthy children after postconception irradiation, were between the ages of eighteen and forty-six. Seven of the women who gave birth to mentally defective children were between the ages of thirty-three and thirty-six at the time of conception. It is very doubtful whether the maternal age had any bearing upon the health of the children.

Previous Maternal History. The previous history of the women was investigated in order to learn if they had borne any defective children prior to the irradiation. The maternal histories of 22 women were

TABLE II

PREVIOUS MATERNAL HISTORIES OF 22 WOMEN IRRADIATED DURING PREGNANCY

Data	Number of Women	Number of Pregnancies or Children
Women having no previous pregnancies	5	0
Women having previous pregnancies	17	76
Women having:		
a. Healthy children	15	65
b. Abnormal children	2	2
c. Abortions	..	6
d. Still-births	..	3

Showing that, of the 22 women having pregnancies prior to irradiation and giving birth to unhealthy children after irradiation, only 2 gave birth to abnormal children (other than still-births) before treatment.

secured (Table II). It will be observed that, of these 22 women, only 2 had given birth to unhealthy children prior to the radiation treatments. The results of all the pregnancies in these 2 women are outlined in Table III. One woman (Case 1) bore a child before irradiation, which child suffered from an affection of the nervous system. The child irradiated *in utero* was a microcephalic idiot.[3] Because of the fact that the child born prior to irradiation exhibited a nervous disease, this case of microcephalic idiocy has been attributed to hereditary influences rather than to the irradiation, though the latter may have been the actual etiological factor.

TABLE III

MATERNITY RECORDS OF 2 WOMEN (FROM TABLE II) GIVING BIRTH TO UNHEALTHY CHILDREN BOTH BEFORE AND AFTER POSTCONCEPTION IRRADIATION

Case	Maternal History *Prior to* Irradiation	Maternal History *After* Irradiation	Reference
1	1 abortion, 1 still-birth (forceps delivery); 1 child, born prematurely, has spasms at 10 years.	1 microcephalic idiot now 3 years of age.	3
2	3 abortions; 1 feeble child, 9 years of age (parents syphilitic).	Child irradiated *in utero* was still-born; a later child is normal at 7 months of age.	12a

Shows the nature of the health disturbance in children born prior to and after postconception irradiation. The ill-health of the children irradiated *in utero*, as listed above, has been attributed to the factors producing the ill-health of the children born prior to irradiation.

The child in Case II was born of syphilitic parents as indicated in Table I. The occurrence of 3 abortions, and the birth of a subnormal child, prior to the irradiation, are confirmatory evidence that this still-born child was syphilitic.

B. *Factors Effective during or after Birth*

Maternal Health during Pregnancy. Information was secured concerning the health of 10 women during the pregnancies which resulted in the birth of unhealthy children. General health was noted as good in these women, aside from the pelvic or other affections which required irradiation. No pregnancy complications were noted other than the ones for which the irradiation was administered.

Influence of Labor upon Child Health. Reports on the labors of 21 women were secured. Labors were normal and spontaneous in 11 of them, while complicated in some manner in the remaining 10.

The nature of the complications, the methods of delivery, and the condition of the children are shown in Table IV. Eight women were delivered by cesarean section, and labor was induced in 2. Only one early infant death[27] may be attributed, with any degree of certainty, to the effect of the obstetrical operation or to other causes incident to the delivery. The nervous and other defects exhibited by the rest of the children described in Table IV cannot be attributed to the nature of the labor or to effects of the delivery, since such defects are not usually observed in children delivered by cesarean section or after induction of labor. According to Tredgold, the total number of cases of mental deficiency directly resulting from abnormal labors probably does not constitute more than 1 or 2 per cent of all idiotic or feeble-minded children.

Ill-health Due to Prematurity. Two children, born after premature labors, exhibited no abnormalities other than those which may be explained by the prematurity (Table V). One child was small at birth, but apparently born at term.

The relation between premature labor and uterine irradiation during pregnancy is not quite understood. It is a generally recognized fact that exposures to large

TABLE IV

UNHEALTHY CHILDREN BORN AFTER COMPLICATED LABORS IN WOMEN IRRADIATED DURING PREGNANCY

Cause of Labor Complication	Method of Delivery: Cesarean Section +; Induction of Labor ++	Condition of Children	Reference
1. Rigid cervix (cancer)	+	Weak, died in 3 hours	27
2. Myoma uteri	+	Normal at birth, died at 2 years of intussusception	33a
3. Myoma uteri	+	Microcephaly	28
4. Myoma uteri	+	Mental and physical development deficient at 6 years	19a
5. Myoma uteri	+	Small at birth and blind	29
6. Myoma uteri	+	Backward in mental and physical development	18
7. Unknown	+	Spina bifida and club-feet	4
8. Carcinoma of cervix	+	Bald at birth, otherwise normal	5
9. Contracted pelvis	++	Microcephaly	3
10. To prevent birth of a living deformed child	++	Child with deformed arms, died in a few days	10

Showing the causes of the abnormal labors, the methods of delivery, and the nature of the health disturbances in 10 children irradiated *in utero*. One early death (Case 1) has been attributed to circumstances incident to delivery. In Case 10 the physician realized the danger of fetal irradiation, and so induced labor prematurely to prevent the birth of a viable, but probably deformed child. Note that the resulting child was seriously malformed.

amounts of radiation will cause abortion. However, as shown in a previous report,[39] the abortion rate was not increased in the group of irradiated women studied therein. The authors have further observed that the fetus is apparently able to withstand large amounts of radiation and to continue its growth to term. It is our belief that the irradiation was not the direct cause of premature labor in the two women referred to above and therefore not responsible for the immaturity of the resulting children.

TABLE V

UNHEALTHY CHILDREN RESULTING FROM PREMATURE LABORS

Case No.	Condition of Children	Reference
1	Weighed 1½ lb. at birth, otherwise normal	30
2	Premature, died in 10 hours	6
3	Small at birth, normal at 6 months (reported as full-term)	7

Showing the condition of health of the children who were immature or small at birth. These children exhibited no abnormalities which could not be attributed to prematurity. It is believed that their condition was not dependent upon the irradiation, except insofar as the irradiation may have been the cause of the premature labor.

Child Health Disturbances Arising after Birth. Two children, not defective at birth, died from accidental causes. One child, apparently asphyxiated at birth, died of pneumonia two days after delivery;[16] the other child, normal at birth, died of intussusception at two years of age.[33a] It is apparent that these two deaths were accidental, and not the result of the maternal irradiation.

SUMMARY OF KNOWN FACTORS (OTHER THAN IRRADIATION) INFLUENCING CHILD HEALTH

The cause of the ill-health of 10 of the 38 children, born after *postconception* maternal pelvic irradiation, has been explained on the basis of influences *other than the irradiation.*

Among these 10 children are included those whose health was influenced by the parental health, conditions incident to birth, prematurity, or circumstances after birth. Any influence that the irradiation may have exerted in the final production of the ill-health or abnormality is, in these cases, considered subservient to, and less important that the factors above mentioned. These children are briefly described; the indications and details of treatment of the mothers, and the outcome of other later pregnancies are shown in Table VI.

Seven of the 10 children were born of mothers receiving roentgen irradiation. In two instances, in which large exposures were administered, the women gave birth to microcephalic idiots.[3,13] The irradiation *may* have been the cause of the microcephaly in these 2 cases but, because as previously mentioned there was some evidence that factors *other than irradiation* may have been responsible, they have been included in this group.

Three children were born of mothers subjected to radium irradiation. Six of the women were irradiated prior to the fifth month of pregnancy, whereas the exact time of irradiation is not known in the other four.

Reports concerning second pregnancies after irradiation were secured in 5 cases. Four women did not conceive again. One woman, who had given birth to a dead

TABLE VI

UNHEALTHY CHILDREN WHOSE ILL-HEALTH HAS BEEN ATTRIBUTED TO CAUSES OTHER THAN IRRADIATION

Case Number	Time of Treatment in Pregnancy + Prior to Fifth Month	Type of Irradiation, Doses of Radium	Indication for Treatment	Children at Birth	Later Development of Children	Later Children	References
1	Unknown	Roentgen ray	Unknown	Small at birth (full term)	Normal at 6 mos.	No report	7
2	+	Roentgen ray	Menorrhagia	Born with asphyxia	Died of pneumonia in 2 days	No report	16
3	+	Roentgen ray	Myoma uteri	Normal	Died of intussusception at 2 yrs.	None (hysterectomy)	33a
4	Unknown	Roentgen ray	Myoma uteri	Still-born (syphilitic)	Dead	One, normal	12a
5	+	Roentgen ray	Myoma uteri	Still-born (macerated)	Dead	None	12b
6	+	Roentgen ray	Pregnancy mistaken for myoma	Weak, head girth 34 cm.	Microcephalic imbecile at 3½ yrs.	No report	3
7	+	Roentgen ray	Induction of abortion, and for castration	Weak, small head	Microcephalic idiot at 3 yrs.	No report	13
8	Unknown	Radium, dose unknown	Unknown	Premature	Died in 10 hrs.	None	6
9	Unknown	Radium, 1110 mg-hr.	Unknown	Small, premature	At 2 mos. weighed 3 lbs.	No report	30
10	+	Radium, 2400 mg-hr.	Carcinoma of cervix	Weak (cesarean section)	Died in few hrs.	None (mother died)	27

Showing details of treatment, the indications for same, and brief descriptions of the unhealthy children irradiated *in utero*.

child[12a] (irradiated while *in utero*), later gave birth to a healthy child.

UNHEALTHY CHILDREN WHOSE DEFECTS COULD NOT BE ATTRIBUTED TO FACTORS OTHER THAN IRRADIATION

This portion of the paper is limited to a consideration of 28 unhealthy or defective children, born after *postconception* irradiation, whose ill-health could not be attributed to any of the factors discussed above. Irradiation remains as the only known influence aside from the normal incidence of ill-health, which may have affected the health of the children in this group. The details of maternal treatment, the kind of irradiation used, the indications for treatment, and brief descriptions of the children irradiated *in utero* and of later children borne by these same mothers, are shown in Tables VII and VIII, and will now be discussed more fully.

Time of Irradiation During Pregnancy. Twenty-three women received roentgen irradiation, and 5 were exposed to the rays of radium. Eighteen of the former group were irradiated during the first few months of gestation, while 3 received roentgen irradiation after the completion of the fourth month of pregnancy. In 2 instances the approximate time was not stated.

Radium was administered to 4 women in the early months of pregnancy, and to one woman as late as the sixth month.[14] It is to be observed that 3 of the 4 children irradiated rather late in fetal life (after the fourth month of gestation), exhibited microcephaly, while one was described as hydrocephalic and deformed. This suggests that irradiation in late as well as in early pregnancy may injuriously affect the offspring. Whether *roentgen* irradiation later than the seventh month of pregnancy will be followed by the birth of defective children is not known.

Amount of Irradiation. A number of observers reported upon the amount of roentgen radiation employed. Since many of these reports were incomplete, and because many different units of measurement were employed, it was found impossible to correlate the amount of roentgen

TABLE VII

UNHEALTHY CHILDREN WHOSE ILL-HEALTH HAS BEEN ATTRIBUTED TO THE ROENTGEN IRRADIATION

Case Number	Time of Treatment in Pregnancy: + Prior to Fifth Mo., ++ Fifth Mo. and Later	Indication	Children at Birth	Later Development	Later Children	Reference
1	+	Myoma uteri	Nystagmus at birth	Mentally and physically subnormal at 6 yrs.	None	19a
2	+	Unknown	Normal	Divergent squint at 7 yrs.	No report	33b
3	+	Myoma uteri	Normal	Mentally and physically subnormal at 6 mos.	None	18
4	Unknown	Diagnostic renal X-ray	Mongoloid cretin	Died in a few days	One, normal	31
5	+	Glioma of cord	Spina bifida and club-feet	Died in 15 days	None	4
6	+	X-ray for tumor of pelvis	Ossification defect of head	No report	No report	23
7	+	Metrorrhagia	Deformity of both forearms	Died in few days	None	10
8	+	Myomi uteri	Premature	Hydrocephalic at 3 wks., died at 2 yrs.	No report	20
9	++	Metrorrhagia	Still-born, hydrocephalic, arms deformed	Dead	None	25
10	+	Ovarian tumor	Apparently normal	Microcephalic idiot at 2 yrs.	One, normal at 3 yrs.	22
11	+	Myoma uteri	Microcephalic	Microcephalic at 3 wks.	None	1
12	+	Unknown	Premature, very small	Microcephalic idiot, died at 2 yrs.	None (hysterectomy)	28
13	+	Metrorrhagia	Premature	Microcephalic idiot at 5 yrs.	No report	34
14	+	Myoma uteri	Small, mongoloid, nevi over abdomen	Microcephalic at 4 yrs.	None	2
15	+	Myoma uteri	Microcephalic	Microcephalic idiot at 6 mos.	No report	8
16	+	Temporary sterilization	Apparently normal	Microcephalic at 4 yrs.	None	9
17	+	Unknown	Small, premature	Microcephalic	No report	11
18	+	Myoma uteri	Unknown	Microcephalic at 6 mos.	No report	26
19	+	Myoma uteri	Premature, head small	Microcephalic idiot at 3 yrs.	No report	32
20	+	Dysmenorrhea and amenorrhea	Weak, hypophalangea of both great toes	Microcephalic imbecile at 8 mos.	No report	35
21	++	Myoma uteri, tuberculous peritonitis	Microcephalic, cleft palate	Microcephalic mongoloid, died at 4 wks.	No report	17
22	++	Carcinoma of cervix	Unknown	Microcephalic at 3 mos.	No report	24
23	Unknown	Metrorrhagia	Unknown	Microcephalic and blind at 8 mos.	No report	15

Showing the details of treatment, the indications for same, and brief descriptions of the unhealthy children irradiated *in utero*.

radiation with the various disturbances observed in the subsequent children. However, the nature of the maternal disease, at least in most instances, probably necessitated intensive irradiation.

The children under consideration in this study were, with one exception, born of mothers who received *therapeutic* pelvic irradiation during pregnancy. The excepted case was an unhealthy child which was described as "a cross between a mongolian idiot and a cretin." Diagnostic roentgeno-

TABLE VIII

UNHEALTHY CHILDREN WHOSE ILL-HEALTH HAS BEEN ATTRIBUTED TO RADIUM IRRADIATION

Case Number	Time of Treatment in Pregnancy: + Prior to Fifth Mo., ++ Fifth Mo. and Later	Filter	Dosage in mg-hr.	Indication	Children at Birth	Later Development	Later Children	References
1	+	Unknown	3712	Carcinoma of cervix	Spots of alopecia on head	Normal at 7 yrs.	No report	5
2	+	Unknown	8000	Epithelioma of left buttock	Patch of alopecia on head	2 wks. old at last report	None	19b
3	+	Unknown	1200	Myoma uteri	Small at birth, apparently blind	No report	None (hysterectomy)	29
4	++	1 mm. brass, and 0.5 mm. aluminum	4440	Carcinoma of cervix	Premature	Microcephalic idiot at 12 yrs.	None	14
5	+	Unknown	Unknown	Early pregnancy mistaken for fibroid	Small, well formed	Microcephalic idiot at 2 yrs.	None (hysterectomy)	21

Showing details of treatment, indications for the same, and brief descriptions of the unhealthy children irradiated *in utero*.

graphic studies of the urinary tract were made in the mother of this child during the fifth and sixth weeks of gestation. Several exposures were made at each of the two examinations.

The known radium dosages are shown in Table VIII, ranging from 1200 to 8000 milligram-hours. It is to be noted that 2 of the children exposed to larger doses of radium exhibited alopecia of the scalp after birth (Nos. 5 and 19b). One child (exposed to 4400 mg-hr. of radium) was a microcephalic idiot,[14] and one child, whose mother had received 1200 mg-hr. was apparently blind at birth.[29] Because of the paucity of material for study it was impossible to reach any conclusion as to the relation between the dose and the severity of defect.

Nature of Child Health Disturbances. The 28 unhealthy children have been divided into two groups, according to whether they exhibited mental or nervous disturbances, or gross physical abnormalities. Twenty of the children belong in the first group, and 8 in the second.

Sixteen children of the first group were microcephalic idiots; 2 were mentally deficient, without gross physical deformities; one was hydrocephalic,[20] and one was a cretin with features of a mongol[31].

The 8 children presenting only defects other than mental, exhibited the following abnormalities of function or structure: Spina bifida and double club-feet,[4] ossification defects of cranial bones,[23] deformities of upper extremities,[10] hydrocephaly and deformities of arms,[25] alopecia of the scalp,[5,19b], divergent squint,[33b] and blindness at birth.[29]

Later Pregnancies in the Irradiated Women. Fifteen reports were obtained concerning the occurrence of later pregnancies in the 28 women who received pelvic irradiation during the pregnancies now under consideration. Thirteen did not conceive again, and this for various reasons (intervening death, hysterectomy, etc.). Two women, however, who had given birth to seriously defective children (irradiated *in utero*), later bore normal children.[22,31] This would seem to indicate that the defects resulted from the direct injurious effects of the irradiation upon the fetus *in utero*, and that the germ cells responsible for the subsequent children were not affected by the irradiation.

DISCUSSION OF FETAL IRRADIATION AS THE CAUSE OF DEFECTS IN CHILDREN

The ill-health of 10 (26.4 per cent) of the 38 unhealthy children, born after *postconception* pelvic irradiation, was explained on the basis of hereditary or environmental influences (other than irradiation). The ill-health or defects of the remaining 28 children (73.6 per cent) could not be attributed to such influences (Table IX) since, as far as is known, they were wanting in these cases.

It is conceivable that the pelvic disease which necessitated the irradiation *may* have been a factor in the production of

TABLE IX
ETIOLOGY OF THE ILL-HEALTH OF 38 CHILDREN IRRADIATED *In Utero*

Type of Ill-health	Etiology Known (Other Than Irradiation)	Etiology Probably in the Irradiation
Mentally defective	2 (doubtful)	20
Deformed (excluding mentally defective)	0	8
Premature, weak or diseased	6	0
Still-births (not deformed)	2	0
	10 (26.4%)	28 (73.6%)

Showing the etiology of the disturbances of health in 38 children irradiated *in utero*, arranged according to causes of ill-health. Note the high percentage of mentally and otherwise defective children, the ill-health of which has been attributed to the irradiation.

the defects in the children. We do not believe this to be the case, however, as only 7 malformed children were borne after *preconception* irradiation[41] by 415 women suffering from pelvic conditions similar to those suffered by the women treated during pregnancy. The maternal pelvic irradiation, therefore, remains as the only known influence to which this *entire* group of 28 children was subjected while *in utero*, and it must be considered the important factor in the etiology of the defects exhibited by these children.

Several other circumstances have convinced us that pelvic irradiation during pregnancy is injurious to the fetus *in utero*. First, the great frequency of developmental defects and congenital anomalies in children born after postconception irradiation (38 of 75 children, or 50.7 per cent) certainly indicates the irradiation to be the important causative factor of the defects. It is our belief that the percentage of congenital defects and arrested mental development is considerably higher in children irradiated *in utero* than among children in general.

Second, defects and anatomical anomalies were observed in only 46 of 417 children born after *preconception* irradiation,[39,40] indicating that only one out of every 10 or 11 children was unhealthy. In the present study it has been evident that one of every two children irradiated *in utero* manifested some disturbance of health.

Third, 28 (37.3 per cent of the entire group of 75 born after *postconception* irradiation) suffered ill-health, the etiology of which could not be determined. Serious structural defects were much more frequently observed in children irradiated *in utero* than in children born after *preconception* pelvic irradiation. These comparisons would seem to indicate that irradiation of the fetus is a dangerous procedure, while irradiation of the ovaries or the non-pregnant uterus is apparently without danger.

Fourth, microcephalic idiocy and mental deficiency occurred very frequently (26.6 per cent) among the 75 children born after postconception irradiation. Doll[38] and Storrs[42], have stated that microcephalic idiocy probably does not occur more frequently than once in every 10,000 or more births. Eighteen cases of this condition occurred among 75 children born of mothers *irradiated during pregnancy*. There was a slight indication that factors other than irradiation may have participated in the production of microcephaly in 2 children. For this reason, we have included these two in the group of children presenting ill-health due to factors other than irradiation. It is our belief *that the microcephaly in at least 16 instances was directly the result of the deleterious action of the radioactive rays upon the central nervous system of the growing embryo.*

The susceptibility to irradiation of the rapidly dividing cells of the central nervous system in the embryo is the probable explanation for the frequent occurrence of microcephalic idiocy, and other types of arrested mental development in children born of mothers irradiated during pregnancy. The few cases of microcephalic idiocy, and the case of hydrocephaly, which occurred in children born of mothers irradiated after the fifth month of pregnancy, may be explained by the fact that the cells of the central nervous system, undergoing rapid mitosis throughout the entire period of embryonal growth, may be harmfully affected in the later part as well as in the early months of gestation.[36]

Tredgold[43] holds that microcephaly is neither atavistic nor accidental, but the result of germ-plasm injury. In 16 cases of

microcephalic idiocy in the children irradiated *in utero*, studied by us, no evidence of neuropathic or other influence was found. If fetal irradiation is accepted as the cause of microcephaly in children, then the present view that this condition has its origin in germ-plasm damage must be modified to include extraneous influences, such as irradiation, acting upon the fetus.

Fifth, anatomical anomalies, other than microcephaly, were also observed frequently among the children irradiated *in utero*. Eight children (10.6 per cent of the 75) manifested physical defects which may have been caused by the irradiation. Statistics concerning the occurrence of malformations and defects (excluding mental disturbances), as they appear in the general population, are not available for comparison with the frequency rate of such malformations and defects among the children irradiated *in utero*. However, we have found that the frequency of deformities (other than mental defects) is extraordinarily high among the irradiated children and, for this reason, we believe that the irradiation was the causative factor in the production of some of them.

SUMMARY AND CONCLUSIONS

1. The etiology of the ill-health or defects manifested by 38, or 50.7 per cent, of a group of 75 children irradiated while *in utero*, has been investigated.

2. The ill-health of 10 children was attributed to parental influences or to accidental causes.

3. Twenty-eight, or 37.3 per cent, of the 75 children born after *postconception* radium or roentgen irradiation manifested mental or physical abnormalities which could not be attributed to parental influences, accidental affections, or causes other than irradiation.

4. In this group of 28 children there were 20 children who suffered severe disturbances of the central nervous system. Sixteen microcephalic children were included in this group.

5. The remaining 8 children exhibited other serious disturbances of health and development, which may have resulted from the irradiation received while *in utero*.

6. The large number of grave malformations appearing in the children born after postconception irradiation, the uniformity of these deformities (chiefly microcephaly and other mental defects), and the infrequency of microcephaly in the general population (one in 10,000 or more births), all strongly indicate that there is a distinct relation between *postconception* irradiation and the occurrence of mental defects in children born after such irradiation.

7. The occurrence of 2 cases of microcephaly and one case of hydrocephaly, in children born of women irradiated after the fifth month of pregnancy, indicates the danger of irradiation of the fetus in the advanced stages of development.

8. No statement can be made as to any relation between the amount of radiation employed and the type of severity of the defect exhibited by the offspring.

9. It is our belief that therapeutic pelvic irradiation *during pregnancy* is extremely likely to seriously injure the growing embryo, and that such injury may result in the birth of a seriously defective child.

10. Finally, it is concluded that there is no indication that diagnostic pelvic irradiation during pregnancy is deleterious in any way to the health of subsequent offspring.

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The bibliography has been divided into two parts: Numbers 1 to 35 include references that contained reports of *unhealthy* children born after postconception pelvic irradiation; numbers 36 to 43 include additional references cited in the text.

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A STUDY OF THE DISTORTION IN ROENTGENOGRAMS TAKEN AT VARIOUS TARGET FILM DISTANCES*

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THE experiments described in this paper were made to study the distortion present in roentgenograms taken at different distances between the tube and film and the object and film. Nearly every clinic uses a definite target film distance apparently without any preconceived idea of the reasons for doing so. In many clinics a standard target film distance of from 24 to 28 inches is used for the usual roentgenographic work. For ordinary purposes this distance does not distort objects sufficiently to destroy the definition of small parts which are close to the film. This distance has become practically universal, probably because the output of the "gas" tube limited the stands and other equipment to this distance and manufacturers have seen no reason to change their equipment to meet other requirements.

Bucky diaphragms are now made to work at a constant target film distance of from 25 to 26 inches. Wilsey[12] (1921) has pointed out the need of placing the grid as close as possible to the film. Very few of the Bucky diaphragms on the market are made with the grid close enough to the film and in some cases they have actually increased the distance between the film and the object. This partially defeats the purpose of the mechanism by decreasing the definition of the part examined though the increase in contrast gives a clearer looking film.

A certain amount of distortion is often a decided advantage in removing confusing superimposed detail such as that present in sinus films, mastoid films, etc. We are so accustomed to see some things distorted that when they are seen undistorted they appear to be queer and often confusing.

From our knowledge of physical optics, it is obvious that the farther the object is from the film, the greater will be the distortion with any given target film distance. In roentgenograms taken of the thicker parts of the body, the chest or pelvis, for example, some parts of the body are 8 or 10 and even 15 inches from the film. Roentgenologists are called upon to give an opinion of the size of various portions of the body in such films. It seems important, therefore, to know just how much distortion there is at different distances and to consider whether or not it would be conducive to better diagnosis of certain conditions to get the tube as far away from the film as is practical with the apparatus now available. Of course, this is of most importance in the thicker parts of the body. Since the intensity of the roentgen beam decreases with an increase in the distance between the target and the film, obviously either the intensity or the time must be increased accordingly. Thus, too great a target film distance defeats its own object by necessitating a large amount of power or a long exposure.

There has been considerable argument about distortion and the proper target film distance ever since the discovery of X-rays by Roentgen (Rosenfeld, 1897). Köhler[7] (1908) first described fairly good films of the chest with the tube moved to a distance of 1.5 to 2 meters and recommended the standing position and deep inspiration for chest films. His exposure time of thirty seconds at the 2 meter distance was just possible for the average patient. He pointed out that Grashey the year before at the Roentgen Congress had used the name "Teleröntgenogramme" for this "Fernphotographie" (i.e., greater than 1 meter) and suggested that the expression be retained for this type of technique. Albers-Schönberg[1] (1908) recognized that the film object and target film distances were vital factors in the study of heart size. He was the first to calculate the true heart image by using the proportion formula. Walter[11] (1917) in a long discussion of the distortion of

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objects roentgenographed at inclined planes with the film, urges further study of this subject. He gives a small table of the projected distortions of a cylinder and sharp cornered bodies at various distances from the surface. Hammer[4] (1917) studied carefully the amount of distortion of hearts in the standing and sitting positions on films taken at 1 and 2 meters and with the orthodiagraph. The orthodiagram of 58 patients, mostly soldiers, was smaller than the heart size in the films. In the 1 meter film with the patient standing it averaged 1.0 cm. less; patient sitting, 0.6 cm. less; at 2 meters, patient standing, 0.4 cm. less and sitting 0.2 cm. less. He recommended that silhouette and area measurements be made upon orthodiagrams rather than upon 2 meter films because they were more nearly correct. He pointed out that his findings of greater distortion (1.5 to 23 per cent) than the calculated distortion (2 to 3 per cent) agrees with the findings of others in practice. Luchsinger[9] (1917) studied the definition of 10 lead wires placed along the hypotenuse of a right-angled triangle in steps 1 cm. apart. This model was placed upon a block 5 cm. above the film so that he could study the definition of the image of these wires with various tubes at a 70 cm. target film distance. He stated in his preliminary report that he intended to study the definition or distortion of deep objects in the tissues by this method but gave no data to speak of. Bardeen[2,3] (1917 and 1918) using the 2 meter distance has stated that "in round numbers the silhouette area must be decreased one per cent for each 3 centimeters of distance from the front to the back of the chest and a given diameter one per cent for each six centimeters . . . or three per cent reduction of a given diameter will give the actual size of the heart contour with sufficient accuracy to obviate the necessity of measuring the antero-posterior diameter of the chest and making a special calculation." He discusses the oblique position of the heart in the thorax and the probable distortion, but beyond discussing the probable distortion no attempt is made to define it accurately. Jewett[6] (1920) in a teleroentgenographic study of the sella turcica found that any object 1 cm. in diameter, 4 inches from the film was enlarged 35 per cent with a target film distance of 15 inches but only 5 per cent with a distance of 5 feet.

LeWald and Turrell[8] (1920) used the method of direct proportion to calculate the true size of the image of the heart taking the contour to be 8 cm. from the film. With the 2 meter distance the true transverse diameter was thought to be 96 per cent of the image and at 75 cm. distance 89.6 per cent.

Smith and Bloedorn[10] (1922) in examining the hearts of 500 midshipmen point out that the amount of distortion of measurements in the chest varies as the target film and target object distances change. They emphasize that the "rays" from the target even at the 6 foot target film distance are not parallel as stated by many authors. For discussion they assume, as have many others, that the plane of the heart lies 8 cm. from the film.

Some clinics retain the 2 meter (6 feet 6 inches) distance for the teleroentgenogram of the heart though many clinics use 4, 6 or 7 feet as their standard distance. Holmes and Ruggles[5] (1926) recommend the last which is probably the most commonly used in the United States.

In considering just what is the best distance to use in making roentgenograms, one must take into account the thickness of the part roentgenographed and the power or output of the machine to be used. For this reason, we have undertaken the study of the amount of distortion of any given object at any given distance from the film or the target, and have compared it with the calculated distortion.

METHOD

In order to study and demonstrate graphically the distortion of the image of an object at any particular distance from the film a model was made to imitate the various conditions under investigation. This model consisted of a series of twelve wooden steps, each 1 inch (2.5 cm.) high and 1 inch (2.5 cm.) deep (Figs. 1 and 2). From the side view the steps occur along the hypotenuse of a right-angled triangle,

the base of which acts as the support and the perpendicular as the back.

As the riser of each step is parallel to the film and from top to bottom, successively 1 inch (2.5 cm.) farther from the film, these risers may be taken to represent vertical planes, 1 inch (2.5 cm.) apart, through the chest or any part of the body.

Fig. 1. Showing the construction of the "model" for the study of definition and distortion at various planes through the body.

Fig. 2. Front view of the model showing the arrangement of the mesh, the rods and the numbers.

On the face of each riser is placed a strip of carefully mounted copper screening. Under one end of the mesh is placed the step number, punched in a square of lead foil. Two small finishing nails set obliquely in the face of each riser, support a brass rod 15 cm. in length. This is about the greatest measurement (length) of the average heart.

By placing films (14″ × 17″) in cassettes against the back of this model, roentgenograms were made of the model at various target film distances from 30 inches up to 10 feet. Thus we have a series of objects of uniform character and size at from 1 to 12 inches from the film whereby we may study definition (mesh and numbers) and measure the actual distortion (rods) of the image. A skeleton with a lead heart silhouette was roentgenographed at various distances and the image measured and compared with the original.

DISCUSSION AND DATA

The distortion of an object in a roentgenogram is of importance to many, though it has a special significance in the study of foreign bodies and in the measurement of the heart. Much of the roentgenologic literature during the late war took into consideration the distortion of the image of foreign bodies in the film, yet we have been unable to find a direct, empirical or mathematical method for reducing the size of the image to its actual dimensions. With relatively larger objects close to the surface in contact with the roentgen film this may be of no practical importance, but for small objects deep within the tissues, where accurate measurements are being made, distortion may hinder the accurate localization of the object. With a fixed object, target and film relation, the distortion can be calculated or measured to a very high degree of exactness. On the other hand, no two foreign bodies, patients, etc., are the same, and the external landmarks can never be localized with the same precision.

A middle course, therefore, with a fair percentage of accuracy is to be desired in practice.

Using the method of similar triangles, the object size can be obtained by direct proportion, if its distance from the film

or target is known or assumed for statistical purposes. This relation is as follows: $\frac{\text{Object size}}{\text{image size}} = \frac{\text{target-object distance}}{\text{target-film distance}}$. If the distortion is plotted in percentage on semi-logarithmic paper, the curve for any constant object film distance and with varying target distances is a hyperbola (Chart III). Its formula is $Y = \frac{1}{X}$, where Y equals the amount of distortion and X, the target object distance. The position of the curve is determined by the object film distance in this case. This gives a simple quick means of calculating the enlargement of an image for any given object film distance at various target film distances. With a constant target film distance and changing object distances, the formula becomes $Y = \frac{O}{X}$ where O equals the object film distance (Chart II). Chart II shows the rate of distortion for various object film distances for the usual working target film distances. If the distance of any object from the film is known, the actual size can be computed quickly from this chart by subtracting the percentage of distortion from the measurements.

Inspection of Charts II, III and IV for the target film distance shows immediately the proper distance at which to take a roentgenogram of an object having a certain object film distance in order to keep the distortion below a certain reasonable percentage.

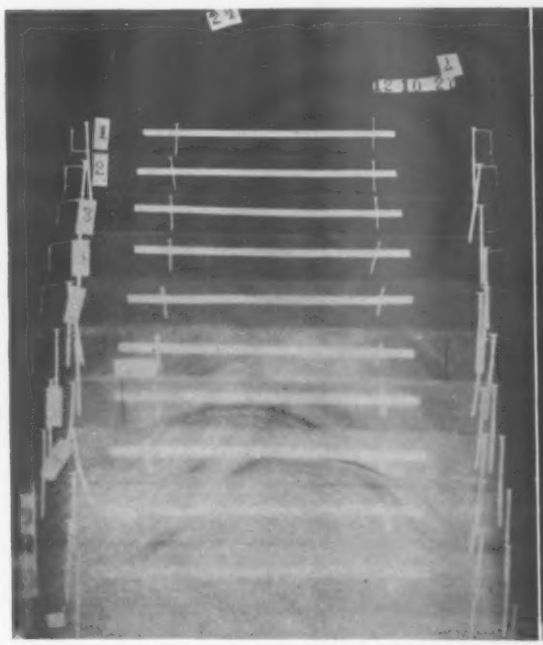

FIG. 3. Roentgenogram taken of the model at a target film distance of 30 inches showing the loss of definition in the 6 inch plane. The distortion of the rod is evident in the second inch plane.

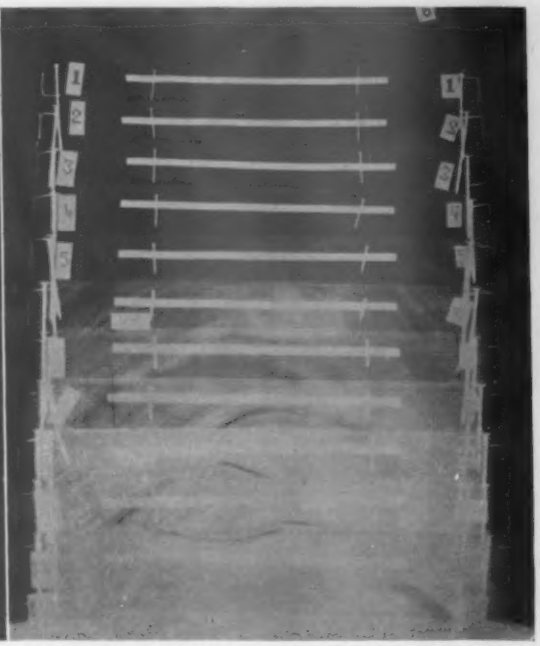

FIG. 4. Roentgenogram taken at a target film distance of 6 feet showing the loss of definition in the tenth to twelfth inch planes and the distortion beginning to be evident in the fourth to sixth inch planes (see Chart I).

Direct measurements upon films taken of the model (Figs. 3 and 4) have been consistent and the observed distortion (Chart I) follows the same curves as the calculated distortion (Chart II) for the different variables. Until the target of a tube is at an infinite distance the distortion does not disappear because the "rays" do not become parallel in effect until an infinite distance is reached.

For practical purposes, the sharp delineation of small objects, by contrasting silhouettes of differing densities, is possible even with considerable distortion present.

The composition of the roentgenographic image, especially with duplitized films, is such that a certain amount of diffusion of borders is always present. A certain amount of blending or shading is unavoidable by secondary radiation or "fogging," which also tends to lessen contrast and therefore to increase the difficulties of obtaining good resolution of the image. Ten per cent distortion of an object 1 mm. in diameter is inappreciable to the eye at the usual viewing distance of 14 to 24 inches. The same enlargement of a large object is apparent on direct (side by side) comparison but is not noticeable, as a rule, in images not having distinct sharp edges (i.e., muscle bundles). On the other hand, sharp, clearly cut images show very distinctly any distortion over 5 per cent. The wire mesh in the model or the bone trabeculae in the ribs, for example, show this clearly. If the anterior chest wall is placed against the film cassette in making chest films, this resolution of small, sharply outlined objects is readily demonstrated. The ribs, near the costochondral junctions, being only 1 to 2 inches from the film, show the fine trabeculation of the cortex with practically any target film distance. The trabeculation in the ribs near the angle of the scapula, however, is indistinct until the target film distance has been increased to 5 feet or more. This is true only in the average chest of 8 inches, anteroposterior diameter. Thicker chests, if accurate detail in the rib cage is desired, must be taken at greater distances. In order to obtain clear cut detail in the bases of the lungs posteriorly for practical purposes, it is necessary to extend the target film distance until the trabeculae in the ribs farthest from the film begin to lose their fuzziness and appear distinctly. Inspection of films of the chest model, a skeleton and patients taken at various target film distances indicate that 6 feet is the minimum distance to be used for the chest examination of the average patient. This distance allows 1 inch between the film and the anterior pleural surfaces. The posterior pleural level may be from 1 to 4 inches from the skin at the angle of the scapula depending upon the amount of subcutaneous fat. The thickest chest measures about 15 inches from sternum to scapula levels. Usually this type of patient supports a generous layer of fat so that 4 inches is not too much to subtract for the posterior pleural level. This leaves 8 inches of lung structures to be studied with as little

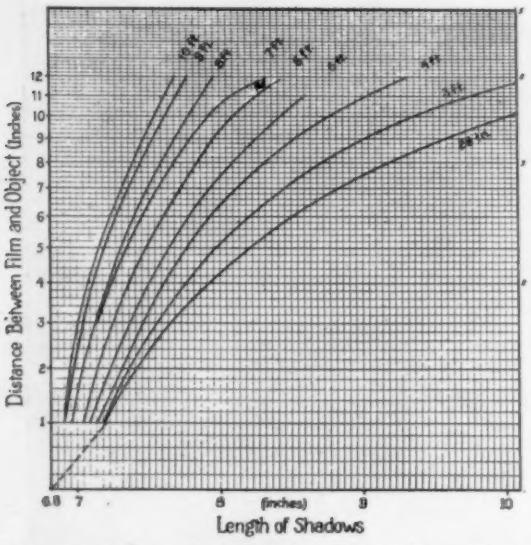

Chart 1. Curves showing the amount of distortion of the rods in the model with different target film distances. The rods were all 6.8 inches in length.

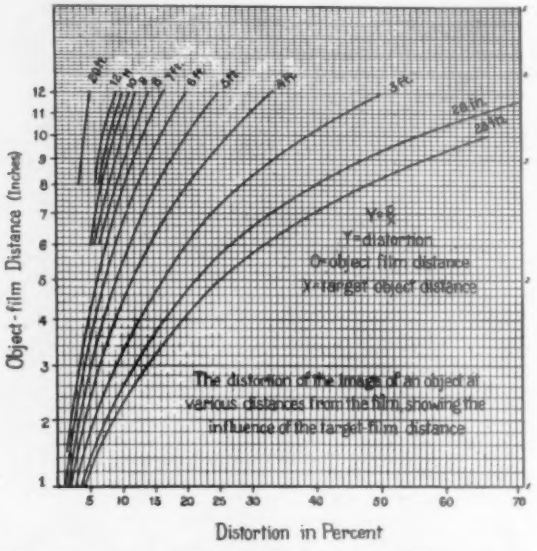
Object-film Distance (Inches)
Distortion in Percent
Y=distortion
O=object film distance
X=target object distance
The distortion of the image of an object at various distances from the film, showing the influence of the target film distance

Chart 11. Curves showing the calculated distortion in percentage for different target film distances. They have the same general shape as those in Chart 1.

distortion as is practical. From Chart II it can be seen that, in the 8 inch plane from the film, the distortion is 12.5 per cent with a 6 foot target film distance. For the 5 foot distance, this is 15.5 per cent and at the 28 inch distance it is 40 per cent. For an 8 foot target distance this is reduced to 6 per cent, and at 20 feet to 3.5 per cent. As the planes approach inch by inch nearer the film, the distortion decreases rapidly. For example, in the plane 7 inches from the film, at the 6 foot distance, the distortion is 11 per cent; and in the 6 inch plane, slightly over 9 per cent. Thus in the stoutest patients with the 6 foot distance, the amount of distortion in the bases of the lung structures is within diagnostic limits. For the average chest of 8 inch thickness, the posterior pleural level is between 1 and 2 inches from the skin and thus comes within the 8 to 9 per cent distortion planes. At this level increasing the target distance a foot only lowers the distortion about 1 per cent.

If the heart is considered to be in the 4 inch plane the differences between the measurements at this level with target distances of 5, 6 and 7 feet will decrease 1 per cent with each foot of increase in distance and at the 6 foot target distance the measurements will be only 6 per cent off.

Chart IV can be used for the estimation of the proper target distance for examining a portion of the body of a certain thickness with a maximum error below a certain percentage. A child's chest of 5 inches certainly does not need the distance that an adult's chest of 8 inches or more would require to attain a definite percentage of accuracy, or sharpness of definition.

The resultant saving in power or increase in accuracy well warrants the trouble in figuring out the needs of various types of examination in the establishment of a new clinic or the rearrangement of an old one. Unless an unusual degree of definition is necessary in the study of thick parts there seems to be little need

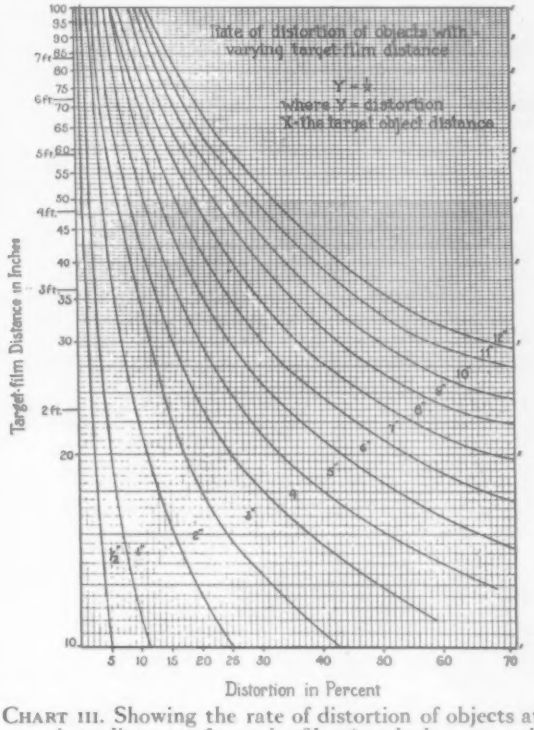
Rate of distortion of objects with varying target-film distance
Y = x/x
where Y = distortion
X = the target object distance
Target-film Distance in Inches
Distortion in Percent

Chart III. Showing the rate of distortion of objects at various distances from the film (marked upon each curve) with varying target film distances.

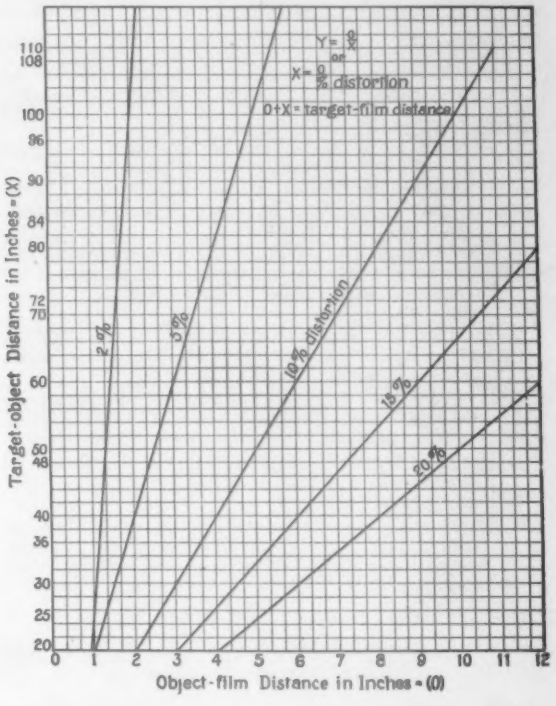

Chart IV. Showing the proper target film distances for obtaining images of objects at various distances from the film under a certain percentage of distortion.

of the use of distances beyond 6 or 7 feet. Suitable increase in target film distance is necessary for accurate visualization of small pathological processes upon a film. This is especially true of the chest. Measurements for statistical study can be made at any distance provided the distortion is calculated or taken into consideration.

SUMMARY

Distortion of the image in a roentgenogram has been studied with the use of a model, a skeleton and the patient. The calculated distortion and the experimental results have agreed closely.

Charts are shown indicating the percentage of distortion at varying distances between target, object and film.*

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HEREDITARY DEFORMING CHONDRODYSPLASIA

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HEREDITARY deforming chondrodysplasia" or "hereditary multiple cartilaginous exostoses" is a condition not altogether rare. Müller,[31] in 1913, in discussing the pathological aspect of the lesion, was able to collect 184 references from the medical literature, while Ehrenfried,[13] in 1915, in an excellent paper on the pathogenesis of the subject reviewed some 300 articles dealing with over 600 cases. Since then many other contributions have been made, so that at the present time there are between 350 and 400 articles with about 700 cases of hereditary deforming chondrodysplasia.

In glancing over the titles of these articles, one is impressed with the variation in the nomenclature used. Multiple cartilaginous exostoses, a term established by Virchow,[42] is the most common, but hereditary multiple exostoses (Gibney[15]), exostoses de croissance multiples (Oulmont[32]), exostoses ostéogéniques (Desgranges[11]), chondral dysplasia (Kienböck[24]), dyschondroplasia (Coon[9]), and multiple congenital osteochondromata (Boggs,[4] Carman and

Fisher,[7] Widmann[43]) are not rare. Other terms used are multiple asymmetrical spongy exostoses (Wright[44]), multiple cancellous exostoses (Maclean,[28] Davis[10]), enchondrose rachitiforme (Boinet[5]), chondromatose ostéogénique associée à des displasies osseuses (Rocher[35]), etc.

In 1915, Ehrenfried[13] applied for the first time the name "hereditary deforming chondrodysplasia," since this embodies the three main characteristics of the disease: (1) the hereditary nature; (2) the tendency to lead to secondary distortions and deformities of the skeleton, and (3) the production of multiple more or less symmetrical cartilaginous or osteocartilaginous growths within or upon the skeletal system. While previously most authors, and among them chiefly Müller,[31] considered the condition as a constitutional anomaly of the perichondrium and periosteum, manifesting itself in an excessive proliferation of cartilaginous tissue, Ehrenfried expressed the opinion that the underlying cause of the disease is a chondrodysplasia resulting from a disturbance in the proliferation and ossification of the bone-forming intermediary cartilage during the period of skeletal growth. The view of Ehrenfried is now endorsed by a great number of investigators, among them Ashhurst,[1] Montgomery,[30] McFarland,[27] and others. We thoroughly agree with McFarland that the name, hereditary deforming chondrodysplasia, "appears to be well founded both etiologically and pathologically and most appropriate," and therefore will use it in further reference to this condition.

The reason for reopening the subject of hereditary deforming chondrodysplasia so thoroughly studied by Bessel Hagen,[2] Müller,[31] and especially by Ehrenfried,[13] is because of our interest in the first postulate of the disease, that is, its hereditary nature. The first demonstrations of inheritance were brought—according to our knowledge—by Marle[29] and Schmidt[36] in 1868, both authors observing the heredity through three generations. Later, Sonnenschein[37] (a case in mother and daughter), Gibney[15] (father, one brother, 2 daughters and one son), Spengler[38] (father and 3 sisters), Herbst[18] (several men in three generations), Griffiths[17] (4 members in three generations), Stolzenberg[39] (father, 4 daughters and 2 sons), Tilmann[40] (father and 5 children), Hoffa[19] (three generations), Läwen[26] (three generations), Francis[14] (grandfather, father and son), Jungmann[21] (grandfather, father, aunt, sister and son), Klasske[23] (father and 3 sons) and Gottstein[16] (grandfather, father, brother and 7 children) reported a rather large number of similar cases extending over a period of several generations. Very interesting in this respect is a family, the successive generations of which were described by three consecutive authors: Cholewa[8] in 1869 reported the grandfather, Braune,[6] in 1882, the father, and Keller,[22] in 1901, the son, all suffering from more or less similar lesions. In 1891, Reinecke,[34] in tabulating the cases previous to 1890 (cited by Ehrenfried[13] and McFarland[27]), found 36 families with 172 cases, of which one showed the condition in five generations; 2 in four generations; 15 in three generations and 12 in two generations. Of the 236 cases collected by Ehrenfried[13] inheritance was demonstrated in 176, no heredity in 18 and the rest remained questionable. Of the 174 cases which occurred in 42 families, in 2 families there was inheritance through four generations, in 15 through three generations and in 21 through two generations. In his most recent paper, Ehrenfried added another family with 8 cases in three generations. Other investigators who reported heredity are Percy[33] (26 affections in four generations), Boggs[4] (father and son), Dwyer[12] (father, son and daughter), Montgomery[30] (5 cases in three generations), Hutchinson[20] (a sailor with definite family history), Ulrich[41] (mother, sister and daughter), Black and Traisman[3] (mother, 3 sons and 3 grandchildren), Langenskiöld[25] (four families with 38 children, 50 per cent of which showed exostoses).

In our case, the disease was present in mother and son, and the disturbances observed were so uniform that the hereditary character of the lesion at once became apparent.

The following is a brief résumé of the history in the two cases:

Case 1. Mrs. M. D., a white, adult female, aged fifty-six, was admitted to the Medical

Service of Harper Hospital Feb. 25, 1929, with a history of urinary disturbance, which was later found to be due to a urethral stricture. The orthopedic condition was merely an incidental finding and was discovered in the course of the routine physical examination in the hospital. As far as could be determined, this condition had been present since the patient was three years of age, and is alleged to have followed an attack of scarlet fever at that time. The first evidence of any abnormality was noticed in the form of a small tumor, firmly attached to the bone, on the inner aspect of the right thigh, just above the knee joint. This increased slowly in size, until seven years ago, when the patient was forty-nine years of age. Since then it has remained stationary. At about the age of puberty, there was noticed a slight abnormality of the right arm near the elbow joint. This likewise slowly progressed until about ten years ago. The only other abnormality of which the patient has been aware is a small tumor at the metacarpophalangeal joint of the left forefinger, present for as long as she can remember. As a result of the arm deformity, complete supination and pronation have never been possible. Except for this, and occasional transient pains in the region of these tumors, there has been no inconvenience or functional disturbance resulting from the orthopedic condition.

Apart from the ordinary diseases of childhood and frequent headaches during the past year, the history has been quite negative. Menstruation started at the age of thirteen, and has always been regular and normal in amount. Menopause occurred six years ago at the age of fifty. The patient had 3 children by her first husband, one of whom forms the subject of the second case, while the other 2 remained entirely normal and without any evidence of bone deformity. There were no children by the second husband. The family history is entirely negative as far as any bone deformities are concerned. Inquiry into this matter was made as far back as it was possible for the patient to remember.

On examination, the patient was found to be a short, stocky, elderly female with intelligence below normal. The head was small and without exostoses or other irregularities. There was a slight deformity of the right ear. The eyes were negative, without evidence of exophthalmos or pupillary disturbance. The thyroid presented a definite, rather firm adenoma. The heart and lungs were negative. Blood pressure, 150/110. The hands and feet were small, the arms and legs short. The only other physical findings of importance were in the skeletal system (see the roentgenological report).

Laboratory examinations while in the hospital revealed nothing of importance. There was no anemia nor leucocytosis, and the urinary findings were negative. Bence-Jones protein was not present in the urine. The blood sugar was 100 mg. and the blood nitrogen 25 mg. Blood Wassermann was negative. Basal metabolism +6 on one occasion and +8 on another.

CASE II. R. D., white, adolescent boy, aged sixteen, youngest son of Mrs. M. D. (Case 1). The boy was brought to the hospital because of numerous skeletal deformities. As far as could be determined, the mother has been conscious of only two of the many deformities which the boy possesses. These consist of a distortion of the right arm at the elbow joint and a firm, bony tumor of the right thigh, just above the knee. These conditions have been present since a very early age, and have become increasingly noticeable. The only functional disturbance has been a limitation in extension of the right forearm beyond an angle of 135°, and a limitation in pronation and supination bilaterally.

Apart from his orthopedic condition, the history of the boy has been unimportant except for the following particulars: His development was retarded with respect to walking and talking, both of which occurred at the age of eighteen months. His defect in speech has since persisted, to a greater or less degree. Because of this, and a rather low intelligence, his progress in school has been slow.

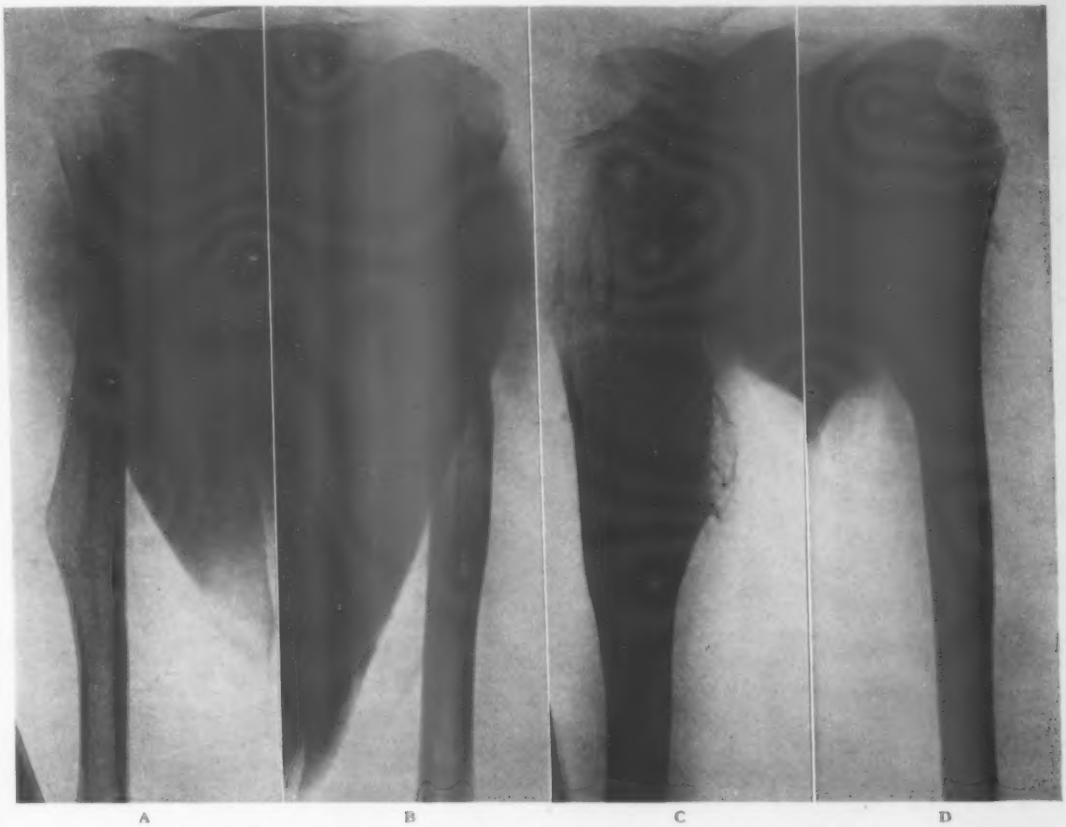
On examination, the patient was found to be an awkward, adolescent youth, obviously below the average in intelligence. The head was large, oddly shaped, somewhat acromegalic in type, without exostoses or other irregularities. The eyes, ears, and nose were negative. The teeth were irregular, but did not show evidence of any metabolic disturbance. The thyroid gland was diffusely enlarged, but not markedly so.

The heart and lungs were negative. Examination of the extremities revealed a distortion of the right elbow, with an angulation of 135°. In the region of the wrists, the ulna was found to end within an inch and a half of the wrist joint, with a slight prominence on the dorsal aspect of the arm in this region. In both legs there was a slight disturbance in the general alignment of the bones, due to small, irregular tumor formations, firmly fixed to the underlying bone and localized to the metaphyseal regions. The malleoli on both legs were unduly prominent.

Roentgenologic Report. The pathological disturbances are chiefly in connection with the extremities.

The Humeri. Both humeri of the mother

show a normal roentgenologic appearance except for a plateau-like hyperostosis at the outer aspect of the mid-portion of the shaft of the right humerus. On the contrary, there are very pronounced changes in the son. The right humerus shows a diffuse thickening in its entire upper portion, with areas of vacuolation and with spur formation at both the outer and inner aspects. The spur formation at the outer aspect is localized 4 cm. and at the inner aspect 10 cm. from the epiphyseal line of the head of the humerus. The epiphyseal line itself is thickened and slightly irregular. The left humerus shows only a limited enlargement of the metaphyseal end, but the irregularity and thickening of the epiphyseal line is the same as on the right side. There is also a plateau-like hyperostosis on the inner aspect of the humerus at the junction of the upper and middle thirds (Fig. 1).



A B C D

FIG. 1. Humeri. A. Mother right. B. Mother left. C. Son right. D. Son left.

The Forearms. The changes here are very marked in both mother and son, with the right side showing, in both instances, the greatest involvement. The right radius of the mother presents a marked shortening, with irregularity in outline and deviation towards the ulnar side. There is an increased density of the bony structures in the upper and middle thirds, and there is a rarefaction in the lower third. There is a very large exostosis at the mesial aspect of the lower third producing a marked displacement of the ulna. The ulna itself is very short, markedly curved, and considerably misshapen, especially at its lower end. At the site of the exostosis, it forms a broad, somewhat irregular surface, leading to pseudarthrosis. Due to the marked shortening, the ulna does not participate in the carpal articulation, but ends about 1½ inches above the joint in a blunt point. A similar condition exists on the left side, with the exception that the radius is considerably longer, and there is no exostosis. Due to this increased length, the ulnar deviation of the radius is more pronounced. The bones of the right forearm of the son have an appearance which is very much like that of the mother on the left side. The radius shows a definite curvature and there is a slight spur formation at the ulnar aspect of the lower end of the radius. The ulna ends blindly and there

is as yet no evidence of pseudarthrosis. On the left side, the radius has maintained its normal length and there is only a slight ulnar deviation

the right ilium with slight hyperostosis just above the acetabulum. There is also thickening with irregular outline of the rami of both

A B C D

Fig. 2. Forearms. A. Mother right. B. Mother left. C. Son right. D. Son left.

with some thickening of the lower metaphyseal end. There is a slight spur formation similar to the one observed on the right radius. Although the ulna is of normal width and considerably longer than on the right side, its lower end still fails to reach the carpal articulation and it forms a pseudarthrosis with the mesial aspect of the radius (Fig. 2).

The carpal bones appear normal in both mother and son. The metacarpals and the phalanges show irregularity in outline as well as shortening and thickening of the shafts in both mother and son, with the changes predominating in the son.

Pelvis and Upper Portion of Femora. The ossa innominata in the mother show nothing of particular interest except for slight spur formation at both anterior iliac crests, as well as at the sacroiliac synchondroses. The upper ends of the femora are likewise negative except for a slight hyperostosis of the lesser trochanter of the right femur (Fig. 3). In the son, the changes are more pronounced. There is irregular architecture of the bony structure of the os pubis and ischium. The upper ends of both femora show considerable thickening in the metaphyseal region, more pronounced on the left side, and there is irregular contour with slight spur formation of both femoral necks (Fig. 4).

Knees. The most important changes, both in the mother and son, are in connection with the knees. There is evidence of large spur formation of both lower ends of the femora and of the upper ends of the tibiae and fibulae. The spurs on the femora extend upward, while those on the tibiae and fibulae extend downward. In the mother, there is, in addition to the enlargement of the metaphyseal ends of both femora and tibiae, a cauliflower-like exostosis located at the inner aspect of the distal portion of the right femur, which results in a rather large tumor mass (Fig. 5). In the son, a similar exostosis begins to form at the outer aspect of the lower end of the right femur (Fig. 6).

In both mother and son, the upper ends of the fibulae form either a fusion or pseudarthrosis with the mesial aspect of the tibiae. The mid-

portions of the shafts of the tibiae and fibulae are fairly normal with the exception of a slight irregularity in contour at the mesial aspect of the left fibula in the mother, and a slight spur formation at the external aspect of the mid-portion of the right fibula in the son.

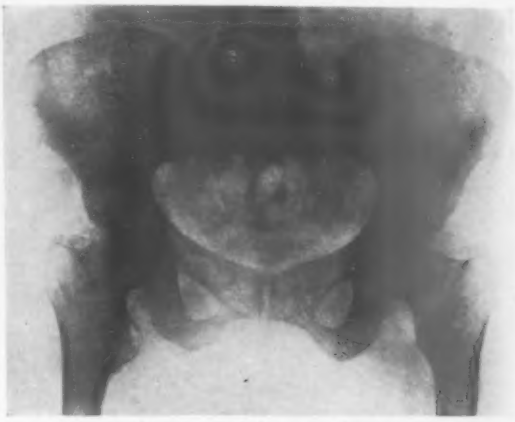


Fig. 3. Pelvis in mother.

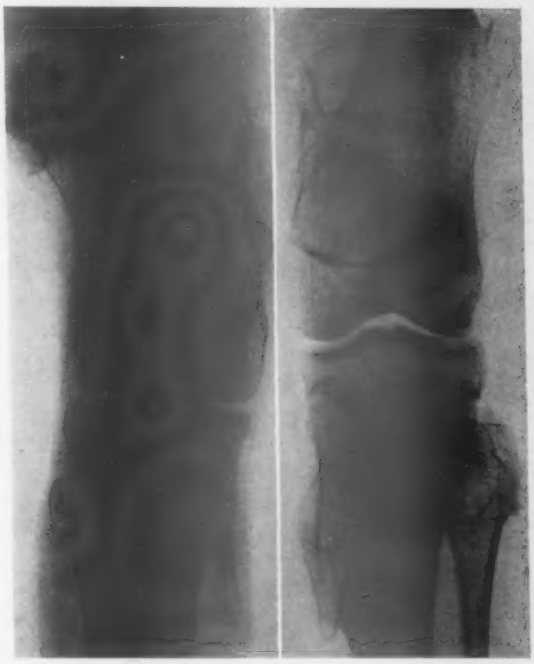
The Ankles. The metaphyseal ends of the tibiae in both mother and son show enlargement, with spur formations extending upward. In the right tibia of the son, there is a marked hyperostosis at the mesial aspect, producing a displacement and distortion of the fibulae. There is, however, no disproportionate shortening of the fibulae and the motion in the ankles is practical normal (Fig. 7). No abnormalities were detected in connection with the metatarsals and the bones of the feet.

Fig. 4. Pelvis in son.

Skull. Although, on physical examination, there was a rather marked prominence of the frontal tuberosities in the son, roentgenograms of the skull were entirely negative for evidence of pathological disturbance. The sella maintained its normal appearance in both mother and son.

A B

Fig. 5. Knees in mother. A. Right. B. Left.



A B

Fig. 6. Knees in son. A. Right. B. Left.

Spine and Ribs. Roentgenograms of the spine and ribs were also negative. There was evidence of a few slight spurs in connection with the ribs, but they were of no clinical significance.

Comment. In summarizing the findings, there is no doubt that the chief disturbances are in connection with the bony structures of the knee. The juxta-epiphyseal hyperostoses are here the most pronounced, and the only cauliflower-like exostoses observed in both mother and son occurred in this region. However, apart from the shortness of the limbs, no marked secondary deformities (genu valgum and varum, pes valgus and varus, club-feet, etc.) resulted from these disturbances in either of our cases. The changes in the bones of the forearm are of a somewhat lesser degree, but the shortening of the ulna, its failure to participate in the carpal articulation and the deviation of the radius towards the ulnar side (which in both mother and son are more pronounced on the right side) gave rise to greater deformities, manifesting themselves in club-hand with limited pronation and supination and in distortion of the elbow with a reduced function in the elbow joint.

The retardation in the skeletal development led to a disproportionate shortness of stature. Both of our patients are below medium height, and the longitudinal center of the body is quite a distance above the pubis.

A B C D

FIG. 7. Lower legs and ankles. A. Mother right. B. Mother left. C. Son right. D. Son left.

It is an interesting fact that although the increase in the size of the exostoses as a rule stops with the cessation of skeletal development, at the age of twenty-two, in the mother this continued until nearly the age of fifty. In the son, the increase in the size of the exostoses, as well as in the degree of deformities, is still continuing. Another feature is the fact that both mother and son showed evidence of definite enlargement of the thyroid gland, with intelligence below the normal. This might suggest a disturbance in the balance of the endocrine system; however, both the metabolic rate and the roentgenologic appearance of the sella turcica proved to be normal.

CONCLUSIONS

The outstanding fact in the two cases presented is the marked similarity of the disturbances in the skeletal system. This similarity approaches parallelism inasmuch as the only cauliflower-like exostoses observed in each case are in connection with the lower portion of the right femur, the only difference being that in the mother the exostosis occurs on the inner aspect of the femur, while in the son it is localized to the outer aspect. This, in our estimation, forms the most conclusive proof that the

condition is of a hereditary nature. On the other hand, it indicates that the skeletal changes are the result of more or less uniform disturbances in the proliferation and ossification of bone-forming cartilage during the period of development as described by Ehrenfried,[13] and not a incidental anomaly of the perichondrium and periosteum as suggested by Müller.[31] For the same reason, we consider "hereditary deforming chondrodysplasia" as the most appropriate term.

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A GIANT CELL TUMOR OF THE RADIUS WITH A POOR RESULT FROM ROENTGEN THERAPY*

CASE REPORT

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A COLORED Pullman porter, aged fifty-two, was first seen in this department Aug. 9, 1928, with a history of pain and swelling in the left wrist of one year's duration. His family history and past history are unessential.

The patient states that twenty-two months ago he wrenched his left wrist between a truck and a railroad car, with uneventful recovery. One year ago he noted difficulty with motion of his wrist. He consulted several doctors in New York, who made a diagnosis of giant cell tumor and advised roentgen treatment. This was begun ten months ago by Dr. M. M. Pomeranz who gave him a suberythema dose divided over a period of ten days, using 180 kv., 50 cm. target-skin distance, and 0.5 mm. copper plus 1 mm. aluminum filter. The tumor was given plenty of opportunity to heal but the progress was extremely slow; in fact, the new bone produced, after the usual radiation reaction as noted by Herendeen, seemed itself to undergo absorption. Consequently the dose was repeated on June 21, 1928. Dr. Pomeranz notes that, "This giant cell tumor has at no time responded as the others have. What the complication is I am unable to state. Perhaps it may be infection or degeneration." The patient states that there has been a steady growth which was accelerated three months ago, but there was no pain until nine weeks ago. Since then there has been a dull aching pain in the wrist with occasional sharp flashes of pain up and down the arm. He has lost 12 pounds in weight in the last three months.

Examination here three weeks before entry (Fig. 3) showed a tense swelling of the lower end of the left radius, measuring about 10 cm. in both diameters, protruding on the radial side. The swelling was not bony hard but of the consistency of cartilage except over the dorsum where the skin was tense, discolored and shiny, with slight reddening, heat and tenderness. The skin appeared distended over a definite area of fluctuation. The wrist was measured carefully and was put on a splint with complete rest for three weeks. At the end of this time the measurements showed a further growth of the tumor, and the fluctuant area on the dorsum of the wrist seemed ready to rupture spontaneously. A general examination, blood, urine, and chest films, revealed nothing unusual.

There was no doubt in our minds that we were dealing with a giant cell tumor which had undergone degeneration and disintegrating changes, and we thought it might be liquefied and under considerable pressure, accounting for the increased destruction noted in the roentgenogram. However, several of the junior members of the staff thought that the rapid destruction of bone and the loss of weight indicated malignancy.

Operation was advised to relieve the pain and the pressure, and Dr. Francis Newton, on Aug. 30, 1928, incised the dorsal surface of the wrist,split the tumor capsule which was distinct and definite, and scooped out the entire contents of the cavity in the bone. The material was largely soft, yellowish and necrotic, rather fatty in appearance, with more grayish active-appearing tissue on the periphery. The periosteum was not removed and no attempt was made to sterilize the cavity chemically in order to save the live periosteum. The dead space was packed with gauze and the hand was supported by a splint in eversion with traction. The wound was kept open, Dakinized daily, and it rapidly filled in with healthy granulation tissue. The patient was discharged Sept. 18, 1928, after twenty-one days in the hospital.

The pathological report by Dr. Bennett on about 200 grams of tumor tissue showed grossly multiform and mutli-colored fragments, many were of yellowish and granular tinge, others were grayish, still others dark red in color. The peripheral portions of the tumor appeared more cellular. The inner portions appeared degenerated. The texture was dense and spongy in nature, of a rubbery consistency, and the tissue tore easily. Microscopic examination revealed tumor cells in clusters embedded in a highly cellular stroma.

There were innumerable polymorphous and various-sized tumor cells, some of them foreign body giant cells, some of them containing cholesterol crystals. Diagnosis: typical giant cell tumor of bone.

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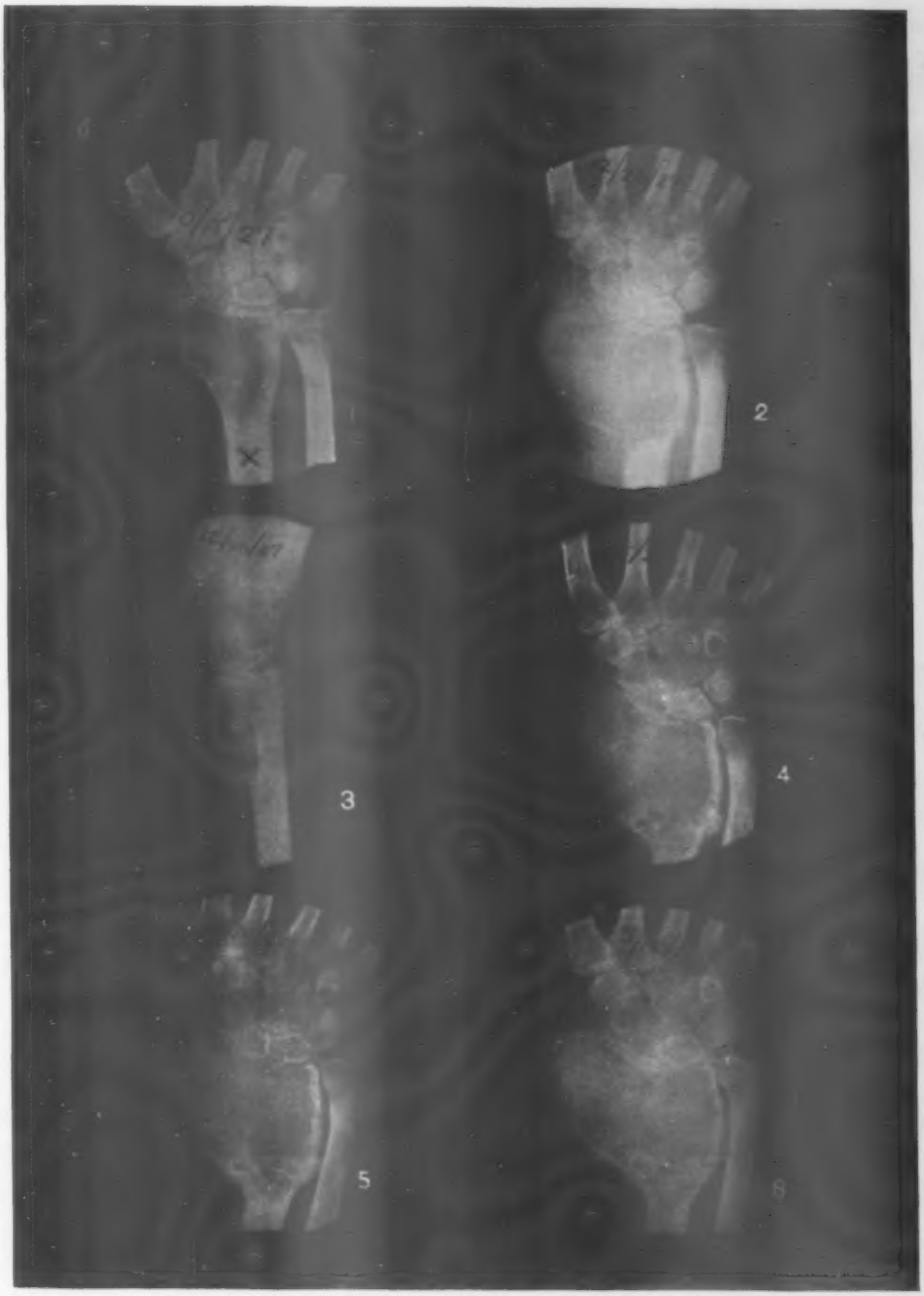
The patient made a satisfactory recovery and on May 20, 1929 (Fig. 4) the left wrist was found to be one inch wider than the right, and there was almost complete bony ankylosis of the wrist joint. There was no pain. The support was good and strength was normal. Flexion, extension and supination of the wrist were almost abolished, but the finger movements were normal. There was no sign of recurrence. The end-result was thought to be fairly satisfactory in view of his occupation as a waiter. The patient was at work



FIGS. 1 and 2. The progressive enlargement of the tumor during and after roentgen treatment.

and found no difficulty in carrying trays or in making other movements necessary in his occupation.

increasing destruction of the bone, so much so that it was hazardous to make a diagnosis of giant cell tumor from the

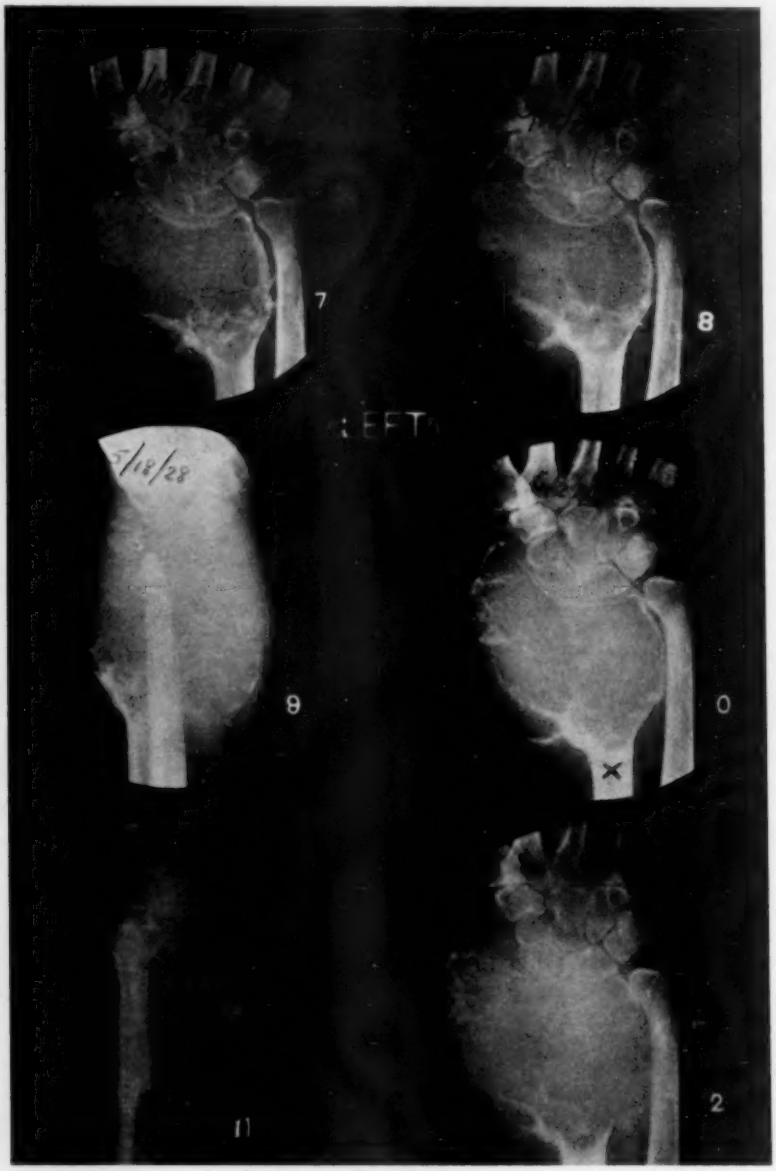


Fig. 2.

Figs. 1 and 2. The progressive enlargement of the tumor during and after roentgen treatment.

DISCUSSION

Inasmuch as many good results have been reported from roentgen treatment of giant cell tumor, it was thought advisable to present a case in which an unfavorable result ensued. Figures 1 and 2 demonstrate the steady growth of the tumor with roentgen examination noted in Figure 3. By the kindness of Dr. Pomeranz, the entire series is made available. The end-result following operation is not entirely satisfactory, though the roentgen appearance is worse than the test of function reveals. A secondary osteoplastic repair of

the deformity has been advised but refused as the patient is satisfied with his present function.

FIG. 3. The appearance of the tumor at the time of admission to this hospital. Note that the bony shell is absent in many places and that there is partial dislocation of the ulna.

It is interesting to note that in spite of the careful and thorough irradiation of the tumor, the pathologist found a zone of actively growing tumor tissue around the periphery. The central necrosis cannot be definitely attributed to roentgen treatment as these tumors are apt to undergo spontaneous central necrosis (Wolbach).

It is useless to speculate as to the possible results in case operation had been undertaken instead of roentgen treatments when the patient was first seen.

FIG. 4. Ths result nine months after thorough curettage of the cavity. There is no evidence of active tumor at present except for a possible focus at the distal end of the normal shaft of the radius. The postoperative collapse is evident and an attempt to prevent this by traction during convalescence was unsuccessful.

ACUTE PULMONARY EDEMA OF ANAPHYLACTIC SHOCK

A CASE REPORT WITH ROENTGEN FINDINGS

BY H. F. DAY, M.D., W. R. SISSON, M.D., AND E. C. VOGT, M.D.

BOSTON, MASSACHUSETTS

THE following case is reported because of the unique opportunity to examine roentgenologically a patient who was in shock after the administration of tetanus antitoxin following a minor operation.

A boy, aged fourteen, was admitted to the Children's Hospital, Dec. 2, 1928, for repair of lacerations and severed tendons of the hands.

Family History. Unessential.

Past History. He had always been healthy, but had had severe serum sickness two years previously following tetanus antitoxin given for a puncture wound of the foot.

Present Illness. About 4:30 in the afternoon on the day of admission the boy was demonstrating a homemade fire extinguisher to some friends in his back yard. He used a large glass bottle partially filled with sodium carbonate in solution. To this was added a small amount of dilute sulphuric acid and the bottle corked. The apparatus exploded in his hands causing several deep lacerations and severance of the flexor tendons of the ring finger. He lost a considerable amount of blood, but not enough to cause any constitutional symptoms. His general condition was good when he reached the hospital at 7:00 P.M.

The anesthetic was started at 7:30. Gas

oxygen was used for induction then ether substituted. During the induction he had moderate epistaxis. He took the anesthetic poorly and it was necessary to use the suction apparatus to clear his throat of a large amount of frothy mucus. This contained some blood which may have been from the nose. He was given atropine sulphate gr. $\frac{1}{100}$ subcutaneously, and the operation was completed at 9:05 P.M. without further trouble.

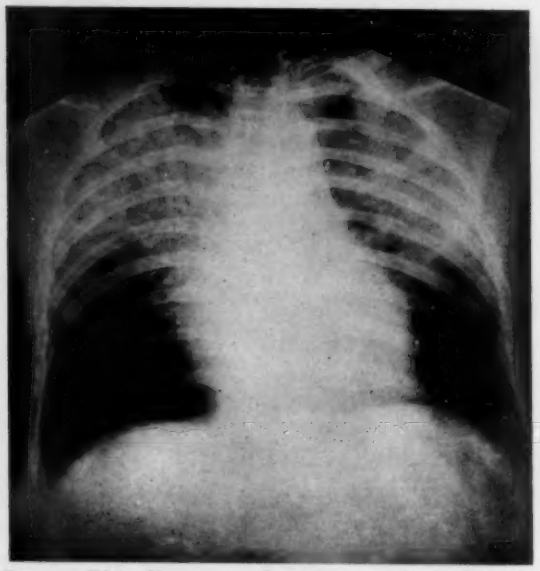


Fig. 1. This film was taken Dec. 3. just after the severe symptoms had subsided and shows a diffuse pulmonary congestion. The bases are evidently already clearing.

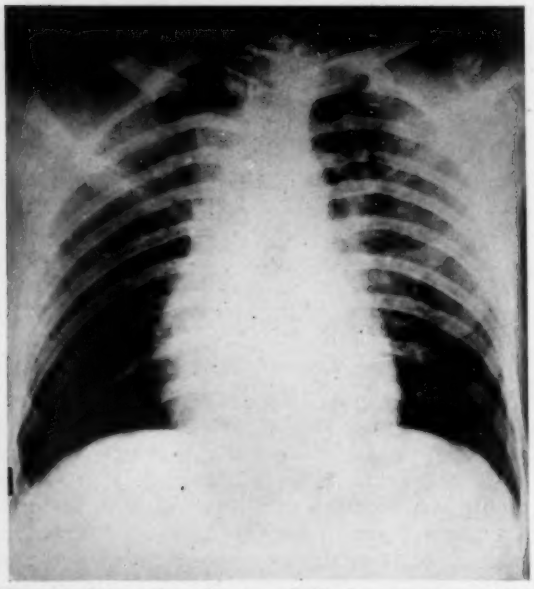


Fig. 2. Film taken Dec. 4. Still shows some residual congestion, though there has been a marked clearing in twenty-four hours.

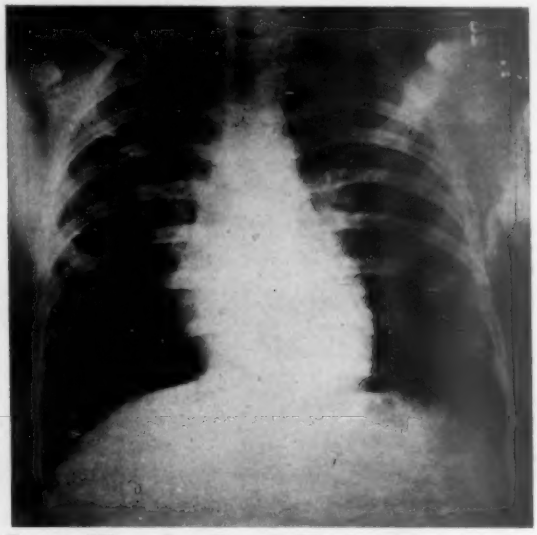


Fig. 3. Film taken Dec. 6. The lungs are now just as clear as they were in a subsequent film taken on Dec. 19.

He was given 1500 units of tetanus antitoxin intramuscularly and returned to bed in fairly good condition. His pulse was 102.

At 9:30 he vomited a small amount of undigested food containing some dark red blood. At 10:20 he vomited about 400 c.c. of bright red blood. He became very restless, dyspneic and cyanotic and was covered with perspiration. His temperature was 102°F., pulse 160 and respiration 60. His lungs were filled with coarse moist râles but no dullness was made out. The heart was not enlarged to percussion. The abdomen was rigid on the right. He was obviously in a critical condition.

Morphine sulphate gr. $\frac{1}{6}$ was given at this time and repeated at 12:10 A.M. At 1:45 he was given atropine sulphate gr. $\frac{1}{150}$. At 3:30 he had another injection of morphine gr. $\frac{1}{6}$. During all this time he was considered to be in extremis, and at 3:45 he was put in the oxygen tent. By 4:00 his color was definitely improved, his pulse was 128 and respiration 32. By 9:00 A.M. Dec. 3, he was quite comfortable with temperature 101.4°F., pulse 140 and respiration 40. The oxygen tent was removed and a film of the chest taken in bed (Fig. 1).

He slept at intervals during the day and took liquid diet. By 7:00 P.M. his temperature was 99.6°F., pulse 112 and respiration 28.

The following morning at 9 o'clock another film of the chest was taken in bed (Fig. 2). He improved rapidly and on Dec. 5, another

film of the chest showed the lungs practically clear.

He was discharged from the hospital on Dec. 6. Figure 3 is a film of the chest taken on that day.

At home he had a moderate attack of urticaria on Dec. 9, which was easily controlled by epinephrin. He remained well and a subsequent examination of the chest on Dec. 19, 1928, was essentially the same as on Dec. 6.

Comment. From the roentgenologist's standpoint the first film was unusually puzzling. It was presented for his interpretation without his knowledge that tetanus antitoxin had been given following the operation. Neither did he know then what chemicals were used in the apparatus which exploded in the boy's hands. He therefore gave only a descriptive report and asked for a reëxamination the next day.

When the complete story became available, and especially when the next film was seen, the diagnosis seemed quite obvious.

FIBROSARCOMA OF THE MEDIASTINUM

CASE REPORT

BY SAMUEL A. ROBINS, M.D.

Roentgen Department, Beth Israel Hospital

BOSTON, MASSACHUSETTS

CASE 8257. S. B. F., aged forty-two, cigar maker, married, was admitted to the service of Dr. Wyman Whittemore at the Beth Israel Hospital, Sept. 12, 1927, complaining of pain in the right shoulder of four months' duration, associated with loss of 8 pounds in weight. During the past month there had been an unproductive cough. A few months previous (July 26, 1927) he was referred for a roentgenographic examination of the right shoulder due to pain over the right scapula radiating to shoulder and right arm

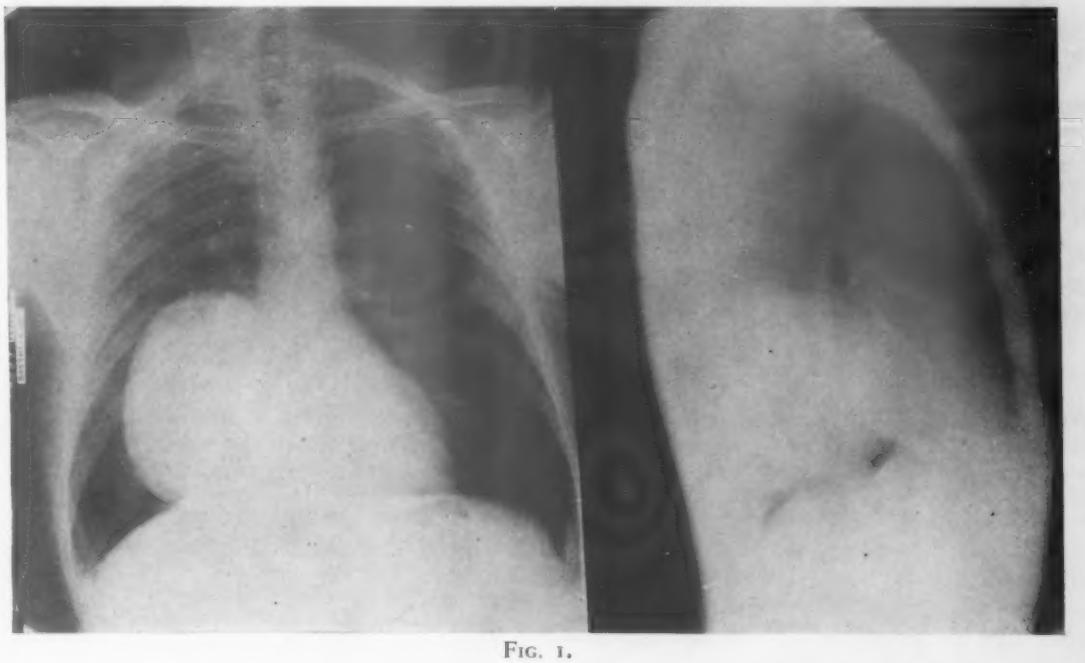


FIG. 1.

which came on suddenly. The roentgenograms revealed no pathological changes in the bones and articular surfaces of the regions examined,

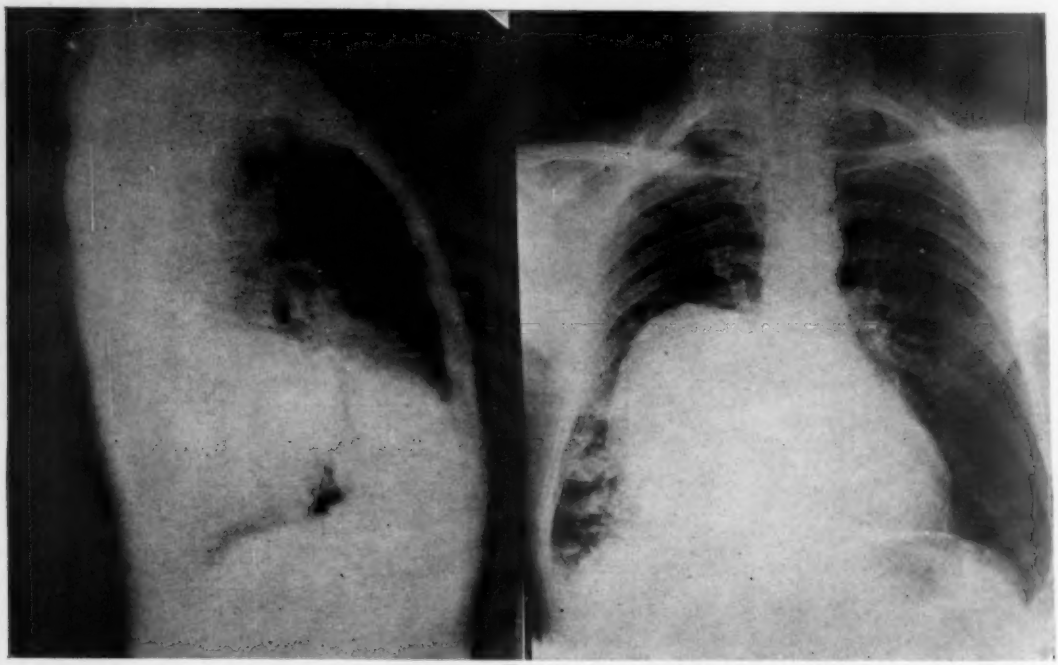


Fig. 2.

but attention was attracted to an ovoid mass in the lower portion of the right lung field.

Stereoroentgenograms of the chest showed an ovoid dense mass with sharply defined borders in the lower vertebral portion of the right lung field about 9.5 × 13.5 cm. in diameter lying close to the posterior chest wall between the eighth and eleventh ribs (Fig. 1).

Roentgenoscopically this mass was not pulsating, did not move with inspiration and expiration and was not connected with the diaphragm. The heart was not displaced.

A bronchographic examination after the injection of 20 c.c. of 40 per cent lipiodol through a bronchoscope by Dr. Louis E. Wolfson showed the right lower trunk well outlined. The mass was posterior, slightly compressing the lower bronchial stem (Fig. 2).

Our impression from the above findings was a large cyst or fibroma.

On Oct. 29, 1927, an operation was performed by Dr. Wyman Whittemore at the Massachusetts General Hospital. A large, hard encapsulated mediastinal tumor about the size of an orange was shelled out from its capsule. A small nodule about the size of a thumbnail was found close to the mass.

The patient died of shock shortly after the operation.

Pathological Report. Fibrous structure composed of elongated spindle cells arranged in interlacing bundles; collagen fibrils were numerous; numerous areas of hyaline degeneration.

Pathological Diagnosis. Fibrosarcoma.

Comment. The interesting facts of this case are the sudden onset, with pain in the right shoulder, and the rarity of the condition.

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HERNIA OF THE URINARY BLADDER

CASE REPORT

BY SAMUEL A. ROBINS, M.D.

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BOSTON, MASSACHUSETTS

CASE 12315. Mrs. R. D., aged sixty, housewife, was admitted to the Beth Israel Hospital April 2, 1927, complaining of dysuria, frequency (every two hours), and hematuria on one occasion two weeks before admission. Urine always cloudy.

Past History. Patient had a pelvic operation in 1922 for the same condition which she now presents, without results; also a cholecystectomy in 1926. Married at age of sixteen. Twelve children living and well; one miscarriage; two still-births; one child died at age of seven.

Since the birth of the last child twenty years ago she has had trouble in moving the bowels and passing water, this condition gradually becoming worse. She had no movements without enemas and had difficulty in starting the urinary stream. The only way she could empty her bowels and bladder was by pressing with her fist on the right buttock.

Physical examination showed nothing unusual except for the local condition which showed a large soft unreducible mass over the right ischiorectal fossa, a cystocele and rectocele. The levator ani muscles on the right side were destroyed.

Cystographic examination (stereoscopic plates) showed a large atonic bladder with a large pouch extending from the right posterior border of the bladder which projects posteriorly and lies close to the tuberosity of the ischium (Fig. 1).

FIG. 1.

FIG. 2.

An operation was performed by Dr. E. G. Crabtree on April 26, 1927, under spinal analgesia. A suprapubic cystotomy was done. The large bladder pouch was excised and the ischiorectal hernia was repaired. The patient made an uneventful recovery and was discharged on May 30, 1927.

The patient was re-examined on Feb. 28, 1928 (Fig. 2). The bladder appeared normal. Symptoms completely relieved.

Comment. The diagnosis in this case would be either a diverticulum or hernia of the bladder. The rarity of diverticula in the female bladder, the unusually large size of the pouch and its position, together with the history, made the diagnosis of hernia of the bladder evident.

CARCINOMA OF THE STOMACH IN A MAN AGED TWENTY-FOUR

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BROOKLYN, NEW YORK

IN reviewing the cases of carcinoma of the stomach, one is more and more impressed with the fact that youth is no bar to the occurrence of carcinoma anywhere in the body. There seems a necessity of stressing this point in view of the so-called "cancer-age" which, if taken too literally, may lead one away from the correct diagnosis, even when suspicious signs are found either by roentgen-ray or chemical examination of the gastric contents. As to the frequency of carcinoma of the stomach in the young, Cabot and Adie as well as Smithies and Ochsner report that they find an incidence of about 2 per cent below the age of thirty. Welch and Kohler report similar findings. Osler and McCrae in the *New York Medical Journal* in 1900 reported the finding of 6 cases under the age of ten, and 13 under the age of twenty in a very large series of cases, both their own and from the literature. Head reported a case in a patient, aged twenty-four, in whom the lesion was present on the lesser curvature and anterior wall. Barr and Allerton reported a case in a boy aged twenty-two in whom the chemical examination showed a free acid of 12 and a total of 32, with the lesion on the posterior wall infiltrating the pancreas. Kretzler mentions a patient of twenty-two in whom the lesion was on the anterior wall, with multiple liver metastases. Golob described a patient aged thirty-one who had no free hydrochloric acid and a total acidity of 4. Frank makes the statement that carcinoma of the stomach is rare in patients under thirty, having found none in 77 cases. It is apparently more frequent in the male than in the female.

FIG. 1.

CASE REPORT

H. B., aged twenty-four, had complained of pain in the upper abdomen since August, 1927. For about ten months previous to this date, he had had frequent nausea, coming on about five minutes after meals and relieved by eating again or by the taking of bicarbonate of soda. He had had no pain or heartburn for some weeks prior to the time observed by us. He complained of cramp-like pains in the abdomen coming on somewhat irregularly after meals until one day he had hematemesis with fainting and collapse. For several days thereafter his stools were black. He then came under our care and the following findings were observed:

Physically, except for marked pallor, he showed nothing. His red count was 4,100,000 with 80 per cent hemoglobin, white cell count 12,000 with 82 per cent polymorphonuclears. Fractional examination of the gastric contents showed free acid ranging from 0 to 6, total acidity from 2 to 14, with positive lactic acid, and positive blood.

Roentgen examination at this time revealed a defect on the greater curvature in the mid-gastric region which was persistent both on roentgenoscopic and on serial film examination. There was likewise to be found a peculiar defect straddling the pyloric sphincter over its

center, suggesting an ulcer involving both the pre- and post-pyloric regions, apparently on the posterior wall (Fig. 1). Because of this patient's age and in spite of the chemical findings already described, we were loath to make a diagnosis of carcinoma of the stomach from the presence of the defect on the greater curvature. Our diagnosis was therefore pyloroduodenal ulcer as suggested by the defect in that region. Had we had more foresight, and been less influenced by the question of so-called "cancer age," the filling defect on the greater curvature would have occupied our attention to a greater extent than it did. However, the patient was operated upon and a large ulcer with a perforation, covered over by omentum, was found on the greater curvature in the region of the defect seen on the roentgenograms. It was about 2 inches in diameter with markedly thickened edges. The surgeon closed the perforation, excised the ulcer area and closed the patient's abdomen without having made a diagnosis of malignancy. It was the pathologist who enlightened us with his report of alveolar carcinoma of the stomach imitating gland structure in many details.

CONCLUSIONS

In retrospect, we should have made a diagnosis of carcinoma in this man of twenty-four in spite of his youth, in view of the chemical findings and the presence of a defect on the greater curvature of the stomach. This case is brought to the attention of the medical profession because of its interest, valuable diagnostic data, and to prevent, if possible, the overlooking of a similar lesion in the future.

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ROENTGENOLOGIC EXAMINATION OF THE DUODENUM

VALUE OF OBLIQUE ROENTGENOGRAPHY

BY ROBERT C. PENDERGRASS, M.D.

The Wise Clinic

AMERICUS, GEORGIA

WITHIN the past few years, an increasing amount of attention has been directed towards the study of diseases of the duodenum. The roentgen examination with the opaque meal has played a major rôle in the diagnosis of duodenal lesions.

At one time, the duodenal ulcer, situated usually in the bulbus duodeni or "cap," held the center of attention, both clinically and roentgenologically. Other lesions were regarded as medical curiosities, and once the question of ulcer was settled, the remainder of the organ was ignored.

Later, the condition known as duodenal ileus was diligently studied and thoroughly presented by many investigators. A highly suggestive clinical picture, graphic roentgenologic findings, elaborate cadaver studies, and relief from symptoms following operative procedures or medical treatment, all combined, have firmly established duodenal ileus as a clinical entity.

Duodenal diverticula, once regarded as anatomic curiosities, are today recognized as the cause of varied pictures of upper abdominal pathology. Careful roentgen studies, elimination of other factors in the causation of symptoms, and operative relief from excision of the diverticula or

gastroenterostomy have proved that diverticula are worthy of serious clinical consideration.

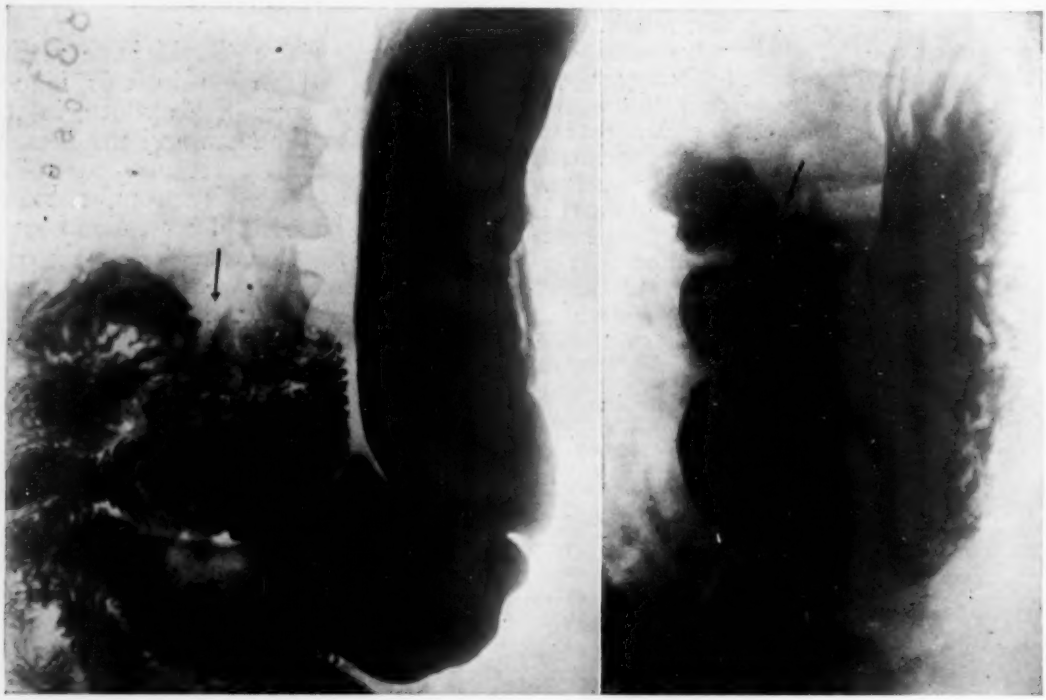
Malignant lesions of the duodenum of a primary nature are somewhat rare; secondary involvement of the duodenum from neighboring growths is more common. While such lesions are notoriously difficult to diagnose, careful clinical, laboratory and roentgenologic studies will reveal many highly suggestive findings.

The demonstration of deformities of the duodenal bulb or loop from extrinsic causes is of value in the collection of diagnostic evidence. All roentgenologists are familiar with the ragged outline of the bulb associated with pericholecystitis and periduodenitis; with the constriction of the lumen of the second portion of the duodenum due to neoplasms in or around the duodenum, and with the enlargement of the duodenal arc by cysts or other tumors of the pancreas or retroperitoneal glands.

With such a fertile field for diagnostic labors in roentgen examination of the duodenum, any and all methods of study should receive careful consideration, and their individual worth be determined by thorough trial.

METHODS OF EXAMINATION

It is not the purpose of this communication to offer any new or original method of roentgen examination of the duodenum, but to emphasize the value of a method already in common usage. We often have at our command simple yet effective methods of study whose worth we are prone to undervalue because of their very simplicity.



A B

Fig. 1. Asthenic habitus. A. Prone position. Bulb obliterated by spine pressure. B. Oblique position, note filled bulb with ulcer niche. No operation.

Obviously, only two methods of study of the duodenum are open to the roentgenologist—roentgenoscopy and roentgenography.

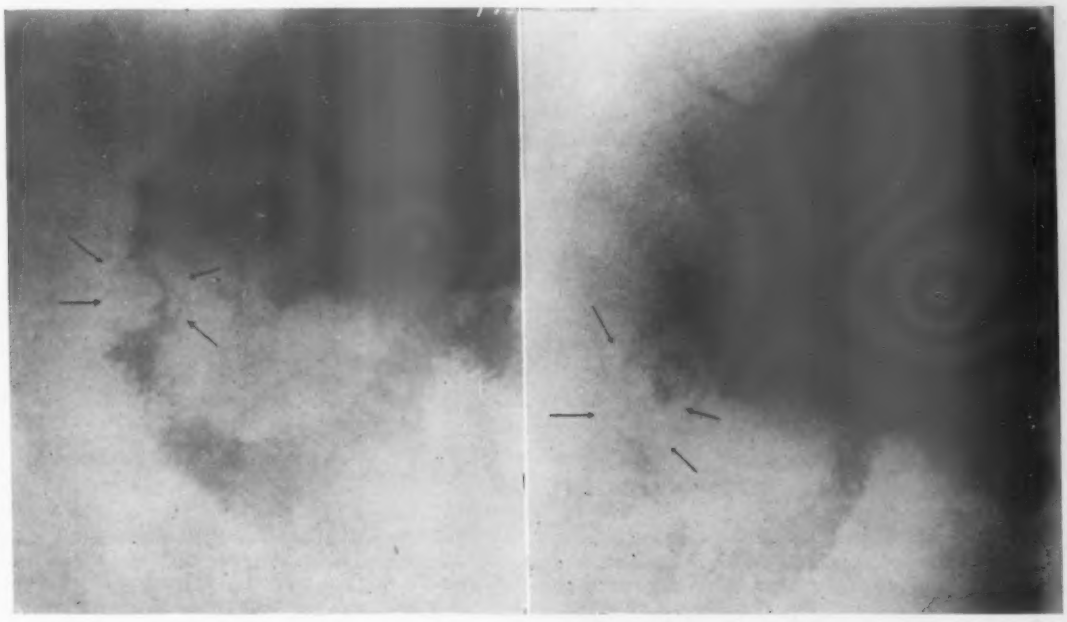
Roentgenoscopy, after administration of the opaque meal, is essential.

Flat films of the upper abdomen may reveal an enlarged liver, positive density gallstones, spinal lesions, renal lesions, pancreatic calcification, or other pathology which can be demonstrated without the opaque meal. The value of such findings needs no emphasis here.

Film examination after the opaque meal knows no boundaries other than the examiner's ingenuity and his judgment

as regards each particular case. If one depends on roentgenoscopic notes, with a few films taken as a matter of record, he may reach a diagnosis readily and often correctly. However, a combination of careful roentgenoscopy, plus films which show the actual condition observed under the screen, will furnish a far more satisfactory basis for diagnosis. It is not always possible to duplicate on the film what is seen on the screen. Conversely, we often demonstrate on the film what we did not see on the screen. This last situation is particularly true in the case of very thick patients, in whom it is not possible to obtain good detail during roentgenoscopy.

A variety of positions may be used to supplement the roentgenoscopic findings or to duplicate them on the film. In addition to the usually employed prone position, the vertical and horizontal positions are often useful. Pillows may be placed under the patient to relieve spine pressure on the stomach and duodenum. In some instances the patient may be placed on the back with the head slightly lowered; this will occasionally throw the stomach above the duodenum and leave the entire loop freely visualized all the way to the duodenojejunal flexure. The direct lateral position, either erect or lying down, will demonstrate malpositions of the cap or loop in some cases. Another method, examination in the oblique position, seems to offer several advantages. It is this position which is here presented as being of proved value in duodenal examinations. No one method can replace another; each case is a law unto itself. The oblique method has proved so satisfactory in the writer's experience that it is now employed almost routinely, in addition to prone position and, occasionally, vertical studies.



A B

FIG. 2. Hypersthenic habitus. A. Prone position. Bulb hidden behind pylorus. Irregularity of greater curvature. Filling defect in loop, marked by arrows. B. Oblique position, disclosing bulb. Filling defect in loop persists as on prone view. Autopsy showed carcinoma of head of pancreas involving duodenum, bile ducts and liver.

Unfortunately, I am unaware as to who first began the use of the oblique position. Its use is widespread. Dr. J. J. Clark, of Atlanta, first called the method to my attention a few years ago.

TECHNIQUE OF OBLIQUE ROENTGENOGRAPHY

The technique employed in oblique roentgenography of the duodenum is as follows:

The patient lies about half way on the

right side, right arm to front, forearm flexed. The left arm is used to steady the body, hand grasping table edge. Angle of spine with table, about 45°. Film under patient, front edge about level with anterior abdominal wall. The central ray is directed over the spine. An 8″ × 10″ film, double screens, is used. Exposure factors are increased about one-half over those for prone position.

This method is also applicable to serial roentgenography, the duodenum being previously centered by roentgenoscopy.

Turning the body in the oblique position not only exposes another angle of the duodenum, but relieves the pressure of the spine on the stomach and the transverse portion of the duodenum. The brunt of the body pressure is thus thrown on the right flank.

A B

Fig. 3. Sthenic habitus. Enlarged liver with jaundice, following cholecystectomy elsewhere eight months previously. A. Prone position. Deformity of lesser curvature due to enlarged liver. Arrangement of duodenal loop obscure, resembling figure eight. B. Exaggerated oblique view, showing formation of loop. Operation showed multiple duodenal adhesions, obliteration of distal half of the common duct by fibrosis. Anastomosis of duct with pyloric portion of stomach. Recovery with clearing of jaundice.

POINTS OF INTEREST IN DUODENAL EXAMINATION

The chief points of interest in the roentgenologic examination of the duodenum are:

1. The action of the pyloric sphincter of the stomach.
2. The position, relations, size, shape, mobility, and motility of the bulbus duodeni.
3. The direction, position, caliber, contour and peristalsis of the duodenum from the bulb to the termination of the third portion.
4. The size and shape of the duodenal arc.
5. The time of retention of duodenal contents.

VALUE OF OBLIQUE POSITION

It is in the study of certain of these above mentioned points that roentgenography in the oblique position seems most useful.

1. *The Duodenal Bulb.* This position affords a more complete visualization of the duodenal bulb.

a. Visualization of the anterior and posterior walls is secured. This is of value in the detection of small ulcer niches, extrinsic pressure defects, etc. (see Fig. 1).

b. In patients of the hypersthenic habitus, the bulb is often hidden by the overlapping pyloric end of the stomach, in the prone position. Both vertical and oblique roentgenography are of value in disclosing the hidden bulb, but the oblique position offers the advantage that the bulb is usually more completely filled (see Fig. 2).

c. In patients of the asthenic habitus, the bulb is usually poorly filled in the erect

position. In the prone position, the bulb may be poorly filled due to spine or body pressure, a condition often occurring in thin patients. By use of the oblique position, such bulbs can be readily filled and demonstrated on the film (see Fig. 1).

fication of extra-luminal shadows filled with barium is more accurately determined.

a. Diverticula. In the prone position, diverticula may be either hidden or their exact relation to the duodenal lumen remain obscure. Oblique roentgenography

A B

FIG. 4. Asthenic habitus. Ulcer symptoms. A. Prone position. Note poor filling of cap. Dense barium clump hidden behind stomach and overlying spine. B. Oblique view. Poor filling of cap due to spasm persists. Diverticulum of third portion of duodenum clearly demonstrated on inner aspect of loop. Operation advised.

2. *The Duodenal Loop*. The position, direction, caliber and contour of the duodenal loop may be more readily studied in the oblique position.

a. In many cases the junction point of the bulb with the remaining first portion lies hidden behind the bulb in the prone position. Oblique roentgenography gives a good exposure of this area. In cases of acute angulation at this site, the oblique position is the only one which will afford a clear view.

b. In the erect and prone positions, the loop is often incompletely filled. The size or caliber of the duodenal lumen is especially important in cases of suspected ileus, tumor deformities, etc. Oblique roentgenography usually shows a filled loop (see Fig. 2).

c. Loop deformities of congenital nature or due to adhesions may be more completely studied with the aid of oblique views (see Fig. 3).

3. *Extra-luminal Shadows*. The identi-

is of marked value in this instance (see Fig. 4).

b. Barium retention in the ampulla of Vater. The classical "collar-button" appearance is not always seen. Occasionally there is a long rod-shaped shadow. In either case, the pyloric portion of the stomach may overlie the filled ampulla in the prone position, casting doubt on the roentgenoscopic observation. The oblique view leaves the loop free of overlapping gastric shadows.

The accompanying illustrations show some of the advantages detailed above.

SUMMARY

1. The value of careful roentgenologic examination of the duodenum is discussed.

2. Various positions and methods of examination are enumerated.

3. The value of roentgenography in the right oblique position, patient lying on right side, is emphasized.

4. Several cases are presented illustrating the value of this method.

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Information of interest to all readers will be found on page ii.

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Delegate to Third International Congress, Paris, July 27–31, 1931: P. M. Hickey, Ann Arbor, Mich.; Alternate, Leopold Jaches, New York City.

Editor: A. C. Christie, 1835 I St., N. W., Washington, D. C.; *Associate Editor,* Lawrence Reynolds, Detroit, Mich.

Editorial Board: James T. Case, H. K. Pancoast, Wm. Duane.

Advisory Board for Pathology: James Ewing, Eugene Opie, Aldred S. Warthin.

Publishers: Paul B. Hoeber, Inc., 76 Fifth Avenue, New York City.

Thirty-first Annual Meeting: 1930, to be announced.

THE AMERICAN RADIUM SOCIETY

President: H. H. Bowing, Mayo Clinic, Rochester, Minn.; *President-Elect:* H. J. Ullmann, Santa Barbara, Calif.; *First Vice-President:* Sanford Withers, Denver, Colo.; *Second Vice-President:* Edith H. Quimby, New York City; *Secretary:* G. W. Grier, Jenkins Arcade, Pittsburgh, Pa.; *Treasurer:* Zoe A. Johnston, Jenkins Arcade, Pittsburgh, Pa.

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Fifteenth Annual Meeting: Book-Cadillac Hotel, Detroit, Mich., June 23–24, 1930.

Committee on Arrangements: R. E. Loucks, Chairman, 337 W. Grand Blvd., Detroit, Mich., R. H. Stevens, Detroit, Mich., L. B. Ashley, Detroit, Mich.

EDITORIAL

THE ANNUAL MEETING

THE Thirtieth Annual Meeting of the American Roentgen Ray Society was held at the Pennsylvania Hotel, New York City, on September 17, 18, 19 and 20, 1929, and those who attended the meeting were handsomely rewarded for their journey, for it is undeniable and stated with a sense of perfect security that during the thirty years of the Society's existence it has not been privileged to listen to a better or more comprehensive program. There are standards in medical meetings and certain ideals in program arrangement, and the New York meeting under the guidance of Dr. Imboden raised ours to a high level. Since the papers presented at the meeting will in due time be published in the Journal, the general excellence of the whole program may then be judged.

A superficial survey of the program reveals the importance and comprehensiveness of the symposia, including as they do papers not only upon diagnosis but therapy as well. These may be mentioned briefly as follows: A symposium on "The Heart and Blood Vessels," arranged by Dr. G. W. Holmes; "Conditions in the Brain and Skull," arranged by Dr. M. C. Sosman; a symposium on "Therapy" including papers on "Treatment of Cancer of the Breast with Radium and X-ray," "Results in a Series of Cases Treated after Five years," "The Roentgen Treatment of Pelvic and Vertebral Metastases from Cancer of the Breast," "Surgical View of Cancer of the Breast," "Treatment of Exophthalmic Goitre and Hyperthyroidism by X-ray," and "Radiation in the Treatment of Menstrual Headaches." There was also a comprehensive symposium on "Diseases of Children" arranged by Dr. E. P. Pendergrass. In addition to the symposia there were of course many other papers of diagnostic importance.

On the evening of the lantern slide exhibit the Society was particularly fortunate in having as its guests Dr. Bergen Davis of the department of physics of Columbia University who gave an address on "Some Properties of X-ray Energy Quantum" and Dr. W. D. Coolidge who gave an interesting description of a new tube—"An X-ray System in which the Focal Spot Size is Automatically Adjusted to the Load."

One of the interesting phases of the meeting were the clinics at some of the New York hospitals, including the Medical Center, Mt. Sinai Hospital and the Memorial Hospital. At the Fifth Avenue Hospital Dr. Lewis Gregory Cole gave the premier demonstration of a roentgen cinematographic apparatus. This is the latest development of an attempt to make roentgenograms on a roll of films sufficiently rapid to demonstrate the actual movements of the stomach, small intestine and colon. These clinics proved to be a very popular and instructive feature of the program and to the members of the staffs of the hospitals who cooperated the Society wishes to express its thanks.

On Wednesday evening, through the courtesy of the New York Academy of Medicine, the meeting was held in their assembly room and the Society was fortunate in having as the speakers for that evening Dr. Chevalier Jackson who gave an address on "Bronchoscopic Aid in the Roentgenological Diagnosis" and Dr. F. H. Baetjer who gave the Caldwell Lecture on "Teaching in Roentgenology."

There were the usual social amenities of the meeting, the banquet being held on Thursday evening.

The physical arrangements of the scientific exhibit and its proximity to the assembly hall added materially to this part of the meeting. The various features of importance in the scientific exhibit are discussed elsewhere. No visitor at the meeting, and there were many, could fail

to be impressed with the entire program and its arrangement, and the Society through the Journal wishes to express its thanks and appreciation to the members who contributed to the success of the meeting, and to the staff of the Pennsylvania Hotel whose courteous manner in handling the multifarious details added greatly to the pleasure of the members and their guests. L. R.

Subscribers to The American Journal of Roentgenology & Radium Therapy *visiting New York City are invited to make the office of the publishers (Paul B. Hoeber, Inc., 76 Fifth Avenue, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan St., Toledo, Ohio.
Thirty-first annual meeting: 1930, to be announced.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual meeting, Detroit, Mich., 1930.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. G. W. Grier, Jenkins Arcade, Pittsburgh, Pa.
Annual meeting, Detroit, Mich., June 23–27, 1930.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. Walter T. Bronson, Northwestern Univ. Med. School, Chicago, Ill.
Fifteenth annual session: New Royal York Hotel, Toronto, Canada, Dec. 2–6, 1929.

RADIOLOGICAL SECTION, LOS ANGELES COUNTY MEDICAL SOCIETY
Secretary, Dr. Lowell S. Goin, Wilshire Medical Building, Los Angeles.
Meets on the third Wednesday of each month at the California Hospital.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. W. S. Lawrence, Medical Arts Bldg., Memphis, Tenn.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. W. T. Bronson, Englewood Hospital.
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Harry L. Farmer, 2930 Prospect Ave.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. E. R. Witwer, Harper Hospital.
Meets monthly on second Friday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee.
Meets first Friday in October, December, February and April.
Place of meeting designated by the president.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. E. Everett Rowell, 200 West 59th St.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary Dr. John T. Farrell, Jr., 235 S. 15th St., Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7.45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Metropolitan Building.
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

UNIVERSITY OF MICHIGAN ROENTGEN RAY SOCIETY
Secretary, Dr. D. M. Clark, University Hospital, Ann Arbor, Mich.
Meets every Wednesday evening from September to July, at 7:30 o'clock in the amphitheatre of the University Hospital.

VIRGINIA ROENTGEN RAY CLUB
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Annual meeting, Charlottesville, Va., Oct. 18, 1929

British Empire

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Director, Dr. John Muir, 32 Welbeck St., London W. 1.

* Secretaries of societies not here listed are requested to send the necessary information to the editor.

Meets on the third Thursday of each month, from November to June inclusive, at 8.15 P.M., at 32 Welbeck St., London, W. 1., or as advertised.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)

Meets on the third Friday of each month during the winter at 8. 30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1

SECTION OF RADIOLOGY AND MEDICAL ELECTRICITY, AUSTRALASIAN MEDICAL CONGRESS

Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

Third session, Sydney, Sept. 2–7, 1929.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION

Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.

Meets monthly at Melbourne during the winter.

SECTION ON RADIOLOGY, CANADIAN MEDICAL ASSOCIATION

Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION

Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.

Meets annually.

Continental Europe

BELGIAN SOCIETY OF ROENTGENOLOGY

Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).

Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

SOCIETE DE RADIOLOGIE MÉDICALE DE FRANCE

Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

SOCIETE FRANCAISE D'ELECTROTHÉRAPIE ET DE RADIOLOGIE MÉDICALE

Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHOSLOVAKIA

Secretary, Dr. Walter Altschul, German University, Prague, 11/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GESELLSCHAFT FÜR RONTGENKUNDE UND STRAHLENFORSCHUNG)

Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.

Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT

Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖNTGENGESELLSCHAFT

Meets annually in different cities.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY

Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA

Secretary, Professor M. Ponzio, University of Turin, Turin.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.

Secretaries, Drs. S. A. Reinberg and S. G. Simonson.

Meets annually.

Sixth Annual Meeting, 1929, to be announced.

LENINGRAD ROENTGEN RAY SOCIETY

Secretaries, Drs. S. G. Simonson and G. A. Gusterin.

Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY

Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.

Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

POLISH SOCIETY OF RADIOLOGY

Secretary, Dr. A. Elektorowicz, 19 Hoza St., Warsaw.

Meets annually.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY

Secretary, Dr. B. Krynski, 11 Zielna St.

Meets once a month except in the summertime.

SCANDINAVIAN ROENTGEN SOCIETIES

The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN

Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY

Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK

Secretary, Dr. O. Wissing, Copenhagen

Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND

Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY

Secretary, Professor Holzknecht, Vienna, IX, General Hospital.

Meets on the first Tuesday of each month from October to July.

SCIENCE ADVISORY COMMITTEE TO THE CENTURY OF PROGRESS

The achievements made in the medical and allied professions during the past one hundred years through the aid of pure and applied science may be graphically shown at the Chicago World's Fair Centennial Celebration to be held in 1933. Leading

authorities in these professions have been invited to serve on the National Research Council Science Advisory Committee to the Fair. They have been asked to advise ways and means as how to interpret in a concrete tangible form the advances made in their respective fields since applied science entered their fields up to the present day.

The medical men serving on the general committee include such wellknown men as: Prof. R. R. Bensley of the Department of Anatomy, of the University of Chicago, on anatomy; Dean Arthur D. Black of the Dental School of Northwestern University, dentistry; Dr. Frank Billings of Chicago, medicine; Prof. Preston M. Hickey of the Medical School of the University of Michigan, roentgenology; Prof. Stanhope Bayne-Jones of the School of Medicine and Dentistry of Rochester University, bacteriology; Prof. Fay-Cooper Cole of the Department of Anthropology of the University of Chicago, anthropology; and Prof. Harvey A. Carr of the Department of Psychology of the University of Chicago, psychology.

The National Research Council Science Advisory Committee was formed at the request of the trustees of the Chicago Exposition. As the most far-reaching scientific body in the United States, the trustees asked the National Research Council to prepare a philosophy for a world's fair which would be of an entirely different character than any exposition ever held before. This philosophy is to deal with the progress made by pure and applied science in industry since the beginning of the so-called Industrial Revolution up the present time. It is planned to make science one of the dominant notes of the Exposition.

Leading engineers and scientists from all sections of the United States are members of this general advisory committee and they will strive to formulate a philosophy for the Exposition that may be suggested as a basic plan for the Fair. The members of the general committee will submit to the executive committee ideas which it is hoped to coordinate into a central working plan by early Fall.

As now planned, the Chicago World's Fair Centennial Celebration, which will be known as "The Century of Progress," will probably offer the most unusual opportunity in the history of science for a physical demonstration of the progress of pure and applied science in the development of industry.

The Science Advisory Committee is headed by an executive committee the members of which are: Dr. Frank B. Jewett, New York, chairman; Dr. George K. Burgess, Washington, D. C.; Dr. Vernon Kellogg, Washington, D. C.; Gano Dunn, New York; Prof. M. I. Pupin, New York, and Dr. William Allen Pusey, of Chicago.

Maurice Holland of New York, has been appointed executive secretary of the committee which has established offices at 40 West 40th Street, New York City.

DR. CASE GOES TO CHICAGO

Dr. James T. Case has resigned from full time work at the Battle Creek Sanitarium and taken up residence in Chicago, where he has opened offices at 303 E. Superior Street. For eighteen years he has maintained his connection with Northwestern University Medical School as head of the Department of Roentgenology, making frequent visits to Chicago for this purpose. Now he will be able to take active personal charge of this department, while carrying on private practice, and in addition will direct the radiological work of the Passavant Memorial Hospital and the Evanston Hospital. Dr. Case still retains his connection with the Battle Creek Sanitarium, making a visit to that institution every Monday.

ANNUAL DINNER TO DR. HOLMES

One of the interesting features of the New York meeting of the American Roentgen Ray Society was the fifth annual dinner to Dr. George W. Holmes of Boston, given by his former students. This is a yearly custom and is growing in interest, as well as in size. At this get-together there were sixteen physicians present besides the guest of honor, among them being Dr. Ruggles of California, Dr. Martin of Texas, Dr. MacCarty of Washington, Dr. Carty of New York, Dr. Golden of New York, Dr. Camp of the Mayo Clinic, Dr.

Sosman of Boston, Dr. Dann of Kansas City, Dr. Warren of Rochester, New York, Dr. Steel of Cleveland, Dr. Thaxter of Portland, Maine, Dr. Sproull of Haverhill, Mass., Dr. Boyd of Providence, Dr. Farmer of Cleveland, and Dr. Reeves of New York City. Some of the former students who were not present sent letters and telegrams.

OFFICERS ELECTED

At the recent annual meeting of the American Roentgen Ray Society in New York City the following officers were elected for the ensuing year: President-elect: A. B. Moore, Rochester, Minn.; 1st Vice-President: Howard E. Ruggles, San Francisco, Calif.; 2d Vice-President: B. H. Nichols, Cleveland, Ohio; Secretary: John T. Murphy (re-elected), Toledo, Ohio; Treasurer: Wm. A. Evans (re-elected), Detroit, Mich.; Librarian and Historian: H. W. Dachtler (re-elected), Toledo, Ohio. Member of the Executive Council: F. M. Hodges, Richmond, Va. The President of the Society is H. M. Imboden, New York City.

THE COMMERCIAL EXHIBIT

The commercial exhibit at the New York meeting was a most attractive one. The hall in which the exhibit was held was roomy, thus lending itself to a satisfactory arrangement of apparatus, and it was separated from the assembly hall by only two foyers and thus was most accessible. Much new apparatus was on display which proved of great interest to those attending the meeting. The following manufacturers were represented: Adlanco Industrial Products Co., American X-ray Corp., Geo. W. Brady Co., Cooper and Cooper, Inc., Cooper Hewitt Co., Eastman Kodak Co., French Screen Co., Paul B. Hoeber, Inc., Horlick's Malted Milk Co., Industrial X-ray Research Laboratories, Kelley-Koett Mfg. Co., National Aniline Chemical Co., Patterson Screen Co., Picker X-ray Corp., Standard X-ray Co., Victor X-ray Corp., Waite and Bartlett Mfg. Co., and Wappler Electric Co.

THE SCIENTIFIC EXHIBIT

The Scientific Exhibit at the New York City meeting was an especially splendid one both as to the number and the quality of the exhibits, and Dr. Belden and his committee are to be congratulated.

The exhibit by Dr. H. K. Pancoast and Dr. E. P. Pendergrass of the University Hospital, Philadelphia, was entitled "The Neck and Upper Respiratory Tract." This exhibit included anatomical charts and films illustrating the various lesions from early childhood to adult life which involve the upper respiratory tract, particular attention being given to the diagnostic points associated with thymic enlargement, especially the compression of the trachea as shown in the lateral position, foreign body shadows in the esophagus and the trachea and tumors of the thyroid with secondary constriction and displacement of the trachea.

Accompanying the exhibit were the concise detailed histories of the various conditions which illustrated the films shown. This method of exhibiting the films is to be commended to those who may in the future desire to make exhibits as the case histories add so much to a full comprehension of the conditions shown.

The completeness and ingenuity of this exhibit were such that it was awarded the first prize.

The William H. Maybury Sanitarium, Detroit, Mich., furnished an exhibit prepared by Dr. Wm. A. Evans and Dr. Max Pinner called "Roentgenological Interpretation Based on Anatomic-Pathological Findings in Pulmonary Tuberculosis." This exhibit included case reports illustrated with roentgenograms, gross pathological pictures of the involved lung, together with photomicrographs. The case history included the roentgen report, the pathological report and the histological study. The photographic transparencies of the gross pathological specimens were so photographed and illuminated as to give a stereoscopic image.

This exhibit on account of its comprehensiveness and its unusual photographic methods was awarded the second prize.

The exhibit from the Memorial Hospital, New York City, was prepared by Dr. Douglas Quick, Edith H. Quimby, Dr. Hayes E. Martin and Dr. George T. Pack, and was entitled "Computations of Tissue

Doses of Radiation in Intra-oral Squamous Carcinoma." Malignant lesions in the various positions were illustrated by transparencies and paraffin models showing the lesions in actual size, also cross section charts at the site of the tumor, with photomicrographs of the lesions. The exhibit also included the case histories giving the site of the primary lesion, the presence or absence of an associated adenopathy, the pathologist's report and the grade of the tumor as to whether it was radioresistant or not, the treatment instituted and the results. These cases were illustrated by three different groups: those where the tissue doses in four cases responded satisfactorily to radiation treatment; tissue doses in four cases not responding satisfactorily to radiation treatment; tissue doses in four cases treated on a basis of "prescription" of definite radiation dosage. An apparatus was shown for obtaining the outline of the transverse section of the head or neck to determine the depth dosage of the radium, thereby making the physical factors involved in the computation of the tissue doses of radiation much easier.

A very comprehensive exhibit from the Department of Roentgenology, New York Hospital, was prepared by Dr. Webster W. Belden. This illustrated various lesions of the bone, including primarily metastatic tumors and inflammatory conditions and an extremely illuminating exhibit of conditions having to do with lesions of the gastrointestinal tract and various conditions showing mediastinal and primary bronchial tumors.

Dr. L. Jaches, Mt. Sinai Hospital, had an exhibit of "Lipiodol Studies." This was an unusual exhibit showing the importance of the use of lipiodol in the diagnosis of intraspinal or cord tumors. The various positions of the spinal cord tumors were illustrated and the diagnostic points of interest given. These were photographs of the films.

The Clinic of the New York Neurological Institute had a comprehensive exhibit prepared by Dr. C. W. Schwartz of the various forms of intracranial tumors, particularly those showing calcification, also pituitary and suprasellar cyst tumors.

From the Philadelphia General Hospital, Radiological Department and Graduate School of Medicine was an exhibit on radiation therapy showing anatomical cross section charts, depth dose charts applied, saturation technique and records of intensity vs. time. This exhibit was arranged by J. L. Weatherwax and Dr. B. P. Widmann.

Dr. Arthur S. Unger, Department of Roentgenology, Sydenham Hospital, had an exhibit of films illustrating the various lesions of the uterus and adnexa shown after the introduction of lipiodol, such as retained placenta, bicornate uterus, fibroid of uterus, hydrosalpingitis, pregnancy, and occlusion of both fallopian tubes.

Dr. Hans Jarre, Grace Hospital, Detroit, Mich., showed films taken with his Cinex-camera, these including a normal bronchus, spastic bronchus and pyeloureterograms. He also had on view the Cinex-camera Model No. 2.

The Strong Memorial Hospital, University of Rochester, had an exhibit prepared by Dr. S. L. Warren on the "Roentgenological Study of the Breast." This exhibit illustrated the remarkable amount of soft tissue detail that can be obtained in roentgen examinations of the breast, showing soft tissue tumor shadows of varying sizes and shapes. Some of the tumors contained calcium. This exhibit illustrated the possibilities of an entirely new field of investigation for the roentgenologist.

An exhibit from the Roentgen-Ray Department, Kansas City General Hospital, was entitled "The Uncoiled Aorta." This was arranged by Dr. David S. Dann and included films of anatomical studies after the injection of opaque media into the aorta and also films of the living illustrating the various aortic and cardiac conditions.

Dr. John R. Carty of the Cornell Clinic had an exhibit of "Lesions of the Gastrointestinal Tract." This included films illustrating the diagnostic significance of lateral curvature of the spine resulting from muscular spasm.

Dr. Albertus Cotton and Dr. H. L. Rogers, Baltimore, exhibited films showing types of fractures, reduced and unreduced and the deformities resulting. This showed the common type of fractures of the

extremities and spine, and also included lantern slides of proved cases of bone tumors.

Dr. Maurice M. Pomeranz, Hospital for Joint Diseases, had an exhibit which included cases illustrating various primary and secondary bone tumors both benign and malignant.

Dr. Theodore West, Port Chester, N. Y., presented "A Case for Diagnosis" and "A Case of Anencephalus."

The various exhibitors gave generously of their time in explaining the purport of their exhibits and the features which they wished to emphasize. Altogether the exhibit was splendidly assembled and disposed and the Society owes the Scientific Exhibit Committee and the exhibitors their heartiest thanks because the work was done in the face of considerable difficulty, such as the recent law passed in New York State prohibiting the exhibition of inflammable films which threatened at one time to entirely disrupt the committee's program. The splendid lighting for these exhibits was made possible through the courtesy of the Cooper-Hewitt Electric Co., Hoboken, N. J., and to them the Society wishes to express its thanks.

Vol. XXII, No. 4

DEPARTMENT OF TECHNIQUE

Department Editor: David R. Bowen, M.D., Pennsylvania Hospital, Philadelphia, Pa.

In this department will be published from time to time, as material is available, suggestions for improvement in technique.

SIGNAL SYSTEM FOR A ROENTGEN DEPARTMENT

BY WILLIAM A. EVANS, M.D.

DETROIT, MICHIGAN

IN a roentgen department provided with numerous dressing rooms much confusion arises and delays occur because the attendants have no convenient method of ascertaining the room to which a patient has been assigned or the type of examination for which he has been referred. To obviate these handicaps a system was devised which would permit signaling to several points in the department that a given room was occupied and at the same time signifying the type of examination desired.

Schedule of X-Ray Examinations

A . . Chest--Fluoroscopic
B . . Chest Radiographic
C . . G. I. Examination, complete
D . . G. U. "
E . . Extremities, "arms, legs, etc."
F . . Dentals

Fig. 1.

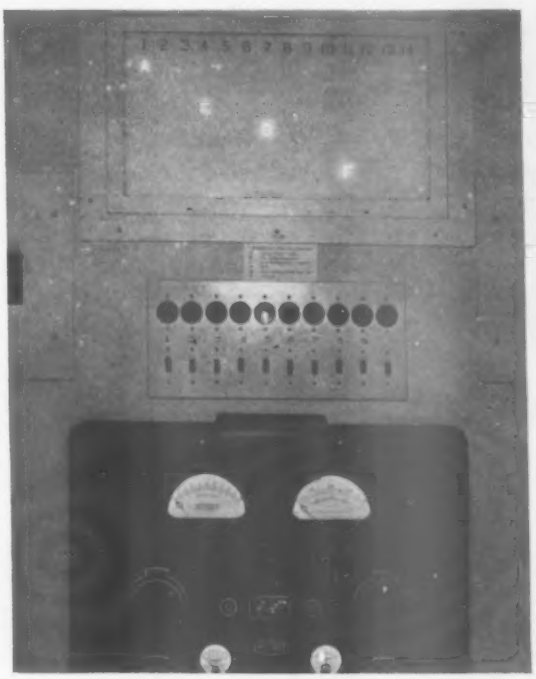

Fig. 2.

Fig. 3.

The essentials of the system include:

First—A Key. Since the institution in which this system is installed is essentially a chest hospital,* the scope of roentgen work is somewhat limited and the majority of examinations could be listed under six headings (Fig. 1). This schedule can of

* This system is installed in the chest unit of the Herman Kiefer Hospital, Detroit, Mich.

course be modified or enlarged to suit any needs.

Second—Signal Stations or Annunciators. The dressing rooms are assigned by number and the numerals 1 to 14 horizontally placed at the upper part of the signal representing them. The letters which indicate the type of examination are placed in order vertically and the construction of the board is such that any or all letters can be signaled for a given dressing room. The plan of the department provides for nine dressing rooms for out-patients and five for in-patients. This accounts for the discrepancy between the numbers on the annunciator and the numbers on the return switch or control signal which appears between the key and the switchboard (Fig. 2).

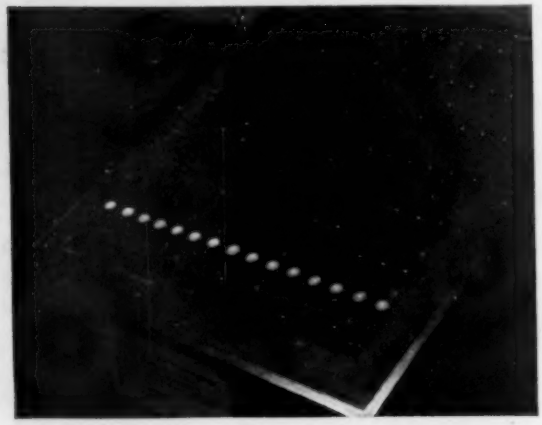

Fig. 4.

The department is provided with eight annunciators, these being placed at the information desk, control rooms, roentgenoscopic rooms, diagnostic rooms, and dark room. The annunciator in the dark room has special lighting features.

Third—The Switchboard. The switchboard is conveniently placed at the desk of the nurse in charge of the reception of patients. The individual button in the horizontal row indicates a single dressing room, and each horizontal row represents a type of examination corresponding with the key. The seventh row—or the row of lamps—is used in connection with the return signal that a study has been made and that the room can be re-assigned (Figs. 3 and 4).

Method of Operation. Figure 2 shows the system in operation. The physician or technicians have been signaled that a patient is in Room 1 for a chest roentgenoscopic study, one in Room 4 for a gastro-intestinal study, one in Room 7 for a study of the urinary tract, and one in Room 11 for a dental examination.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

Bailey, Percival, and Bucy, P. C. Cavernous hemangioma of the vertebrae. *J. Am. M. Ass.*, May 25, 1929, xcii, 1748–1751.

Cavernous hemangioma of the vertebrae is an uncommon condition, there being but 27 cases reported in the literature. Eleven of these produced clinical symptoms, the other 16 were found at autopsy. None of the cases were diagnosed either before necropsy or at operation.

The authors report a case occurring in a woman aged sixty-two. For ten months prior to admission she complained of symptoms and presented physical signs indicative of compression of the spinal cord. A roentgenologic examination revealed a lesion involving the 3d, 5th and 6th dorsal vertebrae. This was interpreted as a metastatic tumor. A thorough search, however, failed to reveal a primary lesion.

It was decided to decompress the spinal cord. A laminectomy from the 4th to the 7th dorsal vertebrae was performed. The removal of the spines of the 5th and 6th vertebrae caused profuse hemorrhage. The laminae of the 6th were found to be greatly increased in thickness. The peridural tissues were also exceedingly vascular. When the dura was opened the cord was found to be compressed by its surrounding hypertrophied walls to a small white nerve-like structure about 4 mm. in diameter.

The patient made a good recovery from the operation and at the time of her discharge from the hospital most of her symptoms had disappeared. Prior to discharge, she received a full erythema dose of roentgen radiation to the involved area in four divided doses.

A microscopic study of the bone removed at operation showed the characteristic picture of a cavernous hemangioma.

This case is the second one of cavernous hemangioma of the vertebrae to have been successfully operated upon.

The point that the authors desire to emphasize is the roentgenologic appearance of the lesion. On the roentgenograms the 3d, 5th and 6th vertebrae presented a distinct striated appearance. In the illustrations, these striations appear as vertical lines in the body and arches of the vertebrae, best seen in the lateral view. Considerable absorption of bone is noted between areas of increased density. The pedicles of the 5th and 6th vertebrae were very much broadened. In addition the posterior border of the involved vertebrae was very indistinct as compared to the normal vertebrae. In two other cases reported in the literature, the appearance of the roentgenograms was identical. Thus the authors state, "We realize now that the picture of reduction in bone density between parallel vertical trabeculae which are increased in density is pathognomonic of angioma of the vertebrae."

As to treatment of this condition the only procedure of any avail is laminectomy. This operation should be approached with a full realization of the difficulties to be encountered because of the profuse hemorrhage. This, unquestionably, is responsible for the high mortality, which is 60 per cent.—*Karl Kornblum.*

Bársony, Theodor, and Koppenstein, Ernst. Streak shadows in the region of the apex of the right lung. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1110–1116.

The streak shadow formation in the region of the apex of the right lung is most commonly observed in azygos lobe.

The author, however, was able to collect two cases with streak formations other than azygos lobe. Roentgenograms taken in a special frontal position revealed that the streaks were due to a flat shadow crossing the upper end of the thorax, transversely, the significance of which is not clearly defined. It might represent a reduplication of the pleura.—*T. Leucutia.*

Blair, Harry C. Carpal osteitis. *Ann. Surg.*, May, 1929, lxxxix, 748–751.

Eight cases of osteitis of the carpal bones are presented, 3 traumatic, 3 occupational and 2 of unknown etiology. The scaphoid and semilunar bones are most commonly involved. In one case the condition was bilateral and all the carpal bones were involved.

The clinical course was the same in all cases. There were three stages: a short period of acute symptoms following injury, then a longer period without symptoms and finally a period of actual disease in which the principal symptoms were pain and swelling in the wrist, tenderness over the involved bones, stiffness and limitation of dorsal extension.

The roentgenological appearances of the condition are typical. No changes are noted in the first period. Early cases show increased density of bone which is followed by malacia producing clear areas. Finally complete crumbling of the bone may occur. The articulating cartilages retain their outline for years.

Treatment of the cases reported consisted of diathermy and immobilization. After prolonged treatment some cases showed filling in of the bone cavities with subsidence of symptoms. It was not found necessary to remove any of the affected bones.—*Karl Kornblum.*

Case, James T. The interpretation of cholecystographic findings; operative check in two hundred and seventy-seven cases. *Ann. Surg.*, Feb., 1929, lxxxix, 222–236.

This is a summary of the practical results of cholecystography in a series of 2000 patients suspected of gall-bladder disease, nearly 300 of whom came to operation. The early history of the roentgenology of the gall-bladder is given, dating back to 1900 when Carl Beck reported several cases of gallstones discovered by roentgen examination.

The relative merits of the direct and indirect signs of gall-bladder disease relied upon before the introduction of cholecystography are discussed. It is shown that the "visualized gall-bladder" (without the introduction of dye) so frequently reported could not be relied upon because such visualization gave no indication of disease and quite often it was the duodenal bulb containing air that was seen.

The author gives in some detail the technique of cholecystography employed. The intravenous method is preferred, although the dye is occasionally given orally. The intravenous injection is made between 4.00 and 5.30 P.M. The evening meal is permitted, the patient advised to confine the diet to carbohydrates. The patient is requested to go home and go to bed for the evening. At 8 o'clock the following morning, before breakfast, two films are made of the gall-bladder region. Films are developed immediately to see that they are technically satisfactory. Breakfast is then taken, the patient eating anything that he desires but including in the breakfast milk or cream and an egg yolk. Two more films are made at 12 noon.

There is a discussion of the reactions to the dye. The intravenous administration is preferred because this technique insures an exact and known quantity of dye entering the blood stream and eliminates any doubt as to absorption when faint gall-bladder shadows are obtained.

The following terminology has been devised in reporting on cholecystographic examinations.

1. Stone Positive. Cases in which it was possible to make a diagnosis of gallstones. Seventy-seven such cases came to operation. Only 3 failed to reveal gallstones. Reliability of Graham test in this group 96.1 per cent.

In this group errors may arise from calcified glands, renal calculi, calcified costal cartilages, calcareous deposits in the gall-bladder wall, gas in the duodenum mistaken for negative shadows in the gall-bladder, and sacculations of the gall-bladder which retain the dye after emptying thus simulating gallstones.

2. Absence of Shadow. The causes for failure to obtain a gall-bladder shadow are given in the order of their frequency.

a. Cystic duct obstruction.
b. Gall-bladder filled with stones.
c. Disease of gall-bladder wall.
d. Obstruction in the common duct.
e. Organic disease of pancreas and liver.
f. Failure of patient to follow dietetic instructions.

In this group 79 patients came to operation. There were 2 errors. Reliability of test 97.5 per cent.

The author states that cases of jaundice almost invariably give "absence of shadow" and they no longer give the Graham test in cases of definite jaundice.

3. Normal. In this group 36 patients came to operation. Three definitely pathological gall-bladders were found. Reliability of test 83.4 per cent.

4. Pathological Noncalculous. In this group the examination was indicative of gall-bladder disease but without evidence of stones. The gall-bladder shadow in these cases was imperfect either in form, density or evacuation. Imperfect form was usually due to external pressure. Failure to properly concentrate the dye was found in the so-called "strawberry" gall-bladder.

In this group there were 85 patients. In 14 of these the gall-bladder was found to be normal. The reliability of the test was 83.6 per cent. In 6 cases gallstones were found. These stones were all small. In the exclusion of stones this group showed a reliability of 93 per cent.

Total cases reported "non-calculous"	121
At operation stones were found in	6
Reliability	95.2%

Such results are only possible with the intravenous method.

VALUE OF GRAHAM TEST TOWARD THE DIAGNOSIS OF CHOLELITHIASIS

Total number of operation cases with stones	138
Graham test report was "absence of shadow" in	58
"Stone positive" in	74
Pathological, noncalculous	6
Normal	0
Reliability	95.7%

In 75 per cent of "absence of shadow" cases gallstones were present.

The author does not advocate the Graham test to the exclusion of other available data such as history, physical findings and other laboratory reports but recognizes the test as so valuable that no surgeon should attempt to do without its aid.

The Graham test is recommended particularly in the differential diagnosis of right upper quadrant densities and is much less distressing to the patient than pyelography for this purpose.—*Karl Kornblum.*

Cave, Paul. Köhler's disease of the second metatarsophalangeal joint. *Brit. M. J.*, April 13, 1929, i, 683.

A case of Köhler's disease of the second metatarsophalangeal joint occurring in a woman, aged twenty, is reported because of the rarity of the condition. Whether it is actually rare or merely overlooked the author is not certain. Clinically, there was intermittent discomfort which eventuated into a red, swollen and painful joint. Duration was four years. It was first noticed while playing hockey.

The roentgenological findings were a marked sclerosis of the entire second metatarsal which was increased in width due to cortical proliferation; no periostitis. The head of the bone presented a rugged concave, instead of convex surface. The base of the first phalanx was ragged and convex instead of concave. There was a wider joint than normal. No true osteoarthritic changes were present.

The disease is found between the ages of ten and eighteen years, more commonly in the female. The right foot is more frequently affected than the left. There are no settled conclusions as to etiology. Some Continental authors have advanced the theory that a series of mechanical insults to the bone result in an aseptic epiphyseal necrosis with obliteration of the vessels of the periosteum and of the articular capsule. The roentgenological appearance is somewhat similar to Perthes' disease of the hip joint. This may point to a common etiological factor.

The reader is referred to Köhler's "Röntgenology" for a full description and bibliography of the condition.—*Karl Kornblum.*

Christopherson, J. B. The radioscopical diagnosis of filariasis. *Brit. M. J.*, May 4, 1929, i, 808.

A case of filariasis due to *F. bancrofti* in which the roentgen demonstration of the calcified encysted filariae was a great aid in the diagnosis. The patient had been a missionary in Africa for thirty-four years. The diagnosis was important because there had been intimate contact with leprosy and this disease was suspected. The blood showed a slight eosinophilia (5 and 9 per cent) but the nocturnal and diurnal blood contained no larvae. The right leg and thigh were a little larger than the left (early elephantiasis).

The roentgenograms showed in the right calf and thigh, small, oblong, cyst-like objects. These were about half an inch long; one end tapered; the other end was broad and round and appeared to be of a lighter shadow.

This finding by roentgen examination is not a common one, evidently due to the fact that in the tropical countries where filariasis is active, study by roentgen rays is usually not available. A somewhat similar roentgen appearance occurs in natives infected with *Cysticercus cellulosae.* The individual cysts in this condition, however, are larger than those of *F. bancrofti.*—*Karl Kornblum.*

Collins, Leon H. Jr., and Kornblum, Karl. Chronic pulmonary infection due to the Friedländer bacillus; a clinical and roentgenologic study. *Arch. Int. Med.*, March, 1929, xliii, 351–362.

Friedländer's pneumonia is an acute pulmonary infection, usually fatal, caused by *Bacillus mucosus-capsulatus* and characterized particularly by a viscid, bloody sputum and lobular involvement of the lung parenchyma with a marked tendency to the formation of secondary multiple abscesses. Three cases are reported by the authors. Of especial interest for the roentgenologist are the typical pathological changes which are the basis of the roentgen picture of the disease. At autopsy the involved area appears to be lobar in type, but on section, multiple small intervening areas of normal lung tissue show that the process is in reality a marked confluent lobular pneumonia or bronchopneumonia. Pleurisy may be a prominent feature. Over the affected area, the visceral and parietal pleura may be densely adherent. It is the rule for multiple abscesses to be found, these varying greatly in size. Between the abscess cavities are seen irregular areas of air containing tissue.

The literature concerning the roentgen aspects of Friedländer's pneumonia is extremely meager. The authors recognize the onset of the disease as a bronchopneumonia, the roentgenologic features of which do not differ materially from bronchopneumonia due to other organisms. This stage of the disease is of such short duration that it is unlikely that many patients are examined by means of the roentgen ray during this period.

The lobular patches of the primary bronchopneumonia coalesce rapidly to form larger areas which give the lung the appearance of a lobar pneumonia. This differs from an ordinary pneumococcic lobar pneumonia in that the consolidation does not appear to be as complete and as homogeneous and is not definitely limited to a single lobe. The involvement is usually most intense in the periphery of the lung. Several such consolidations may be present in the same or the opposite lung. These characteristics have given rise to the condition being known as a pseudolobar pneumonia.

After a variable length of time, less rapidly in the non-fatal cases, extensive destruction of the tissue of the lung in the involved areas occurs, which leads to the formation of multiple abscesses and cavities. This gives rise to a characteristic roentgenographic appearance, which differs from all other acute pulmonary infections with the possible exception of influenza.

It is in this stage that the disease usually terminates fatally. In those exceptional cases in which recovery occurs the authors have learned from their roentgenologic studies that the involved areas of the lung become the seat of an extensive fibrosis often with the persistence of cavities. They believe this residual fibrosis to be more or less permanent.

On the basis of this pathological condition, they recognize roentgenographically four stages of the disease: (1) the stage of primary bronchopneumonia; (2) the stage of pseudolobar pneumonia; (3) the stage of formation of multiple abscesses and cavities, and (4) the stage of fibrosis.

The clinical signs and symptoms are fully discussed. The outstanding physical manifestation of the 3 cases reported was the extreme indolence of the lesion of the chest. Several months after the acute infection, evidence of pathological change could be demonstrated by physical and by roentgen examination.

From their study of the disease, the authors believe there is a chronic form of pulmonary disease due to the Friedländer bacillus. This is, in many respects, similar to chronic pulmonary tuberculosis. They feel that in cases of suspected tuberculosis in which organisms cannot be found the sputum should be examined for the Friedländer bacillus.—*R. S. Bromer.*

Crowden, Guy P., and Harris, H. A. The effect of obstructed respiration on heart and lungs; its clinical importance in radiography. *Brit. M. J.*, March 9, 1929, i, 439–441.

Marked changes occur in the lungs as the result of the propagation of the pulse wave through the pulmonary vascular tree with each systole of the heart. These changes occur with remarkable rapidity probably within $\frac{1}{60}$ of a second. Few hospitals are equipped to make roentgenograms as rapidly as this. To secure uniform chest films it is essential that the exposures be made during a definite phase of the cardiac cycle as well as in a particular phase of respiration. This has been successfully accomplished by McPhedran and Weyl of the Henry Phipps Institute, Philadelphia, by a specially devised apparatus.

The authors in observing two roentgenograms of a certain individual were impressed by the marked variation in the appearance of the root shadows. They thought this might be due to changes in the amount of blood in the heart and lungs at the time the exposures were made. To verify this, they made standard roentgenograms of the chest of a subject utilizing the classical experiments of Valsalva (1740) and Johannes Müller (1838) to vary the amount of blood in the heart and lungs. In Valsalva's experiment the subject after taking a deep inspiration closes the glottis and a strenuous and prolonged expiratory effort is made but without permitting air to escape. The resulting marked increase in intrathoracic pressure prevents the normal inflow of venous blood into the chest from the neck and abdomen and empties the pulmonary circulation. This causes a marked diminution in the size of the heart and great vessels and in the roentgenograms reveals much of the root shadows that are normally concealed. Müller's experiment is essentially the reverse. The glottis is closed at the end of a deep expiration and an attempt is made forcibly to inspire. This produces a diminution in intrathoracic pressure or an increase in the negative intrapleural pressure, thus lessening the resistance to the inflow of blood into the chest. As a result of the increased amount of blood, the heart and great vessels and pulmonary circulation become engorged. On the roentgenogram, the heart is seen to be enlarged, the root shadows are largely concealed by the great vessels and there is con-

siderable accentuation of the linear markings of the lungs, quite the reverse of the previous experiment.

By connecting a mercury manometer to a tube in the subject's mouth and clipping the nose, obstruction to respiration was produced and at the same time it was possible to measure the pressure of the air in the lungs. Thus by variations in the experiments of Valsalva and Müller, in which the intrapleural pressure varied from a positive pressure of 75 mm. Hg to a negative pressure of 95 mm. Hg, the authors secured six roentgenograms of the same chest which showed distinct variations from each other.

Attention is called to the significance of the dead spaces in the chest. These dead spaces filled by loose alveolar tissue in the living, are never seen in the dissections of formalin-fixed cadavers. These spaces permit extreme distention of the veins and determine the spread and expansion of enlarged lymphatic glands and tumors. The left lung root encircled by the rigid arch of the aorta does not permit expansion of enlarged lymph nodes but the right hilus which is encircled by the less resistant vena azygos major and superior vena cava offers space for the enlargement of glands. This is the reason given for the frequency of enlarged lymph glands on the right side of the mediastinum. It is responsible for the phenomenon of right-sided paravertebral dullness, emphasized by Riviere, and of d'Espine's sign. Likewise, Opie has shown that the common calcium-bearing glandular lesions are right-sided irrespective of the side in which the pulmonary glandular lesions occur.

From these considerations it becomes imperative that the lung roots be freed from the shadow of the heart and great vessels if instructive roentgenograms relative to the enlargement of the hilus glands are to be had. This can be accomplished by utilizing the experiment of Valsalva. Attention is called to the fact that these experiments are not devoid of danger in the aged and patients suffering from cardiovascular disease.

In conclusion, it is pointed out that the experiments of Valsalva and Müller show the need for further standardization in routine roentgenography.

A brief study of the six roentgenograms presented indicates the need for the re-consideration of many of the terms used by the roentgenologist. Such terms as "dilated heart," "peribronchial fibrosis," and "increased hilus shadows" may have to be abandoned.—*Karl Kornblum.*

Dressler, Ludwig. Newer investigations on the roentgenologic visualization of the male urethra, prostate and seminal vesicles. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, xxxix, 872–882.

The simultaneous roentgenologic visualization of the anterior and posterior portion of the urethra is possible by a slight change in the Langer-Wittkowsky technique which is as follows: the patient is placed on the back (on a Potter-Bucky table) with one leg extended and the other abducted in the hip and flexed in the knee joint (the pelvis being rotated 40° towards the stretched leg), and roentgenograms are taken with the incidence of the rays over the symphysis. However, instead of making the exposure during the micturition of the injected contrast solution (as in the original technique) the roentgenogram is taken during the actual time of injection, which must be done slowly. Thirty to 50 c.c. iodipin (20 per cent) is all that is necessary to obtain a good visualization of the entire urethra. It is advisable to start with the roentgen exposure after 20 to 30 c.c. have been injected.

The method is of considerable value in developmental anomalies of the urethra (accessory urethra, diverticula, fistula formation, etc.), in gonorrheic prostatitis (showing enlargement of both lobes of the prostate and a change of configuration of the trigone), hypertrophy of the prostate (there being a marked filling defect due to protrusion of the enlarged prostate into the bladder lumen), strictures, etc.

The method is advised as an adjunct to endoscopy and sound exploration.—*T. Leucutia.*

Emery, Edward S., and Monroe, Robert G. Peptic ulcer; a study of 556 cases. *Arch. Int. Med.*, June, 1929, xliii, 846–873.

This paper is an analysis of 556 cases of chronic peptic ulcer seen during the years 1913 to 1926. The incidence, symptomatology, laboratory observations and complications are discussed at length, and because of the great amount of detail presented, this portion of the paper does not lend itself to concise summarization.

Hyperacidity occurred in 50 per cent of cases. There was only one proved case of achlorhydria, and in this the diagnosis of ulcer was made only by the roentgen ray, there being no symptoms of the disease.

The roentgen ray failed to show evidence of an ulcer in 36 cases (7 per cent).

Hemorrhage occurred in 194 (34.8 per cent) of cases and was the cause of death in 8. Seventy-seven of this group had more than one hemorrhage. It was the first sign of the disease in 25. After a rather high incidence in the first two years of symptoms, the proportion fell to 23 per cent and remained there.

Acute perforation occurred in 38 patients, 11 of whom (28 per cent) died. There was no tendency for this complication to appear early in the course of the disease.

Cancer was found in 6 of the 135 cases of gastric ulcer (4.4 per cent); of these, 3 apparently developed from the ulcer. This is an interesting observation in view of the present discussion whether ulcer is a forerunner of cancer.

Retention occurred in 135 cases, 92 being due to pyloric spasm.

Hour-glass deformity occurred in 16, as shown by the roentgen ray. Six of these were spasmodic, no deformity being found at operation. In all except 2 cases the ulcers were situated on the lesser curvature of the stomach; one of these was on the posterior wall of the stomach near the lesser curvature, and the other in the duodenum with an associated contracture of the stomach. In one of the 13 patients who came to operation the ulcer appeared to be healed. The rest showed open craters surrounded by some infiltration, and 3 had become adherent to the pancreas. One had formed a fistulous communication with the duodenum. No good cause was found to explain the organic stricture.

No greater incidence of foci of infection was found in this group than in the general hospital population.

Ulcer was the cause of death in 41 cases to date: 21 patients died following operation.

The results of all forms of treatment showed that about 60 per cent of the patients were relieved after an average observation period of four years. The strict Sippy treatment proved to be the best of the medical methods, and gastroenterostomy with plication of the pylorus the best of the surgical methods. Surgical measures were somewhat more effective than medical, but this was offset by the fact that the results in the cases in which surgical measures were employed were worse than the ones in which medical treatment was given.

Roentgen examinations have often been sadly misinterpreted in reporting the results of treatment. Disappearance of the gastric niche following treatment has been considered strong evidence for healing, and the infrequent disappearance of the duodenal deformity has been attributed to permanent scar tissue contraction. Critical study of the roentgen observations in cases followed for a long period of time, however, strongly supports the idea that ulcer is a chronic disease. Time and again the gastric niche has been seen to smooth out under the most superficial measures, and to return promptly after the completion of even the most intensive treatments, medical or surgical.

The authors believe that credit is due chiefly to roentgenologists for the considerable advance in the knowledge of peptic ulcer. The roentgenologists have not only simplified the diagnosis but have led to a better understanding of the pathologic physiology and the complications of the disease.

Roentgen-ray studies were made in 510 cases of the series, and definite ulcers were shown in 474 (93 per cent). Roentgen examination failed to show the ulcer in 36 cases (7 per cent); 18 of the latter were shown to have an ulcer at operation; 6 in addition to typical symptoms, had had one or more hemorrhages, and the diagnosis in 12 was based on the history and reaction to treatment alone. Sixteen of the patients were seen before 1919, in the developmental period of the roentgenographic signs of ulcer, and one would expect more cases to be missed then than now. In the hands of a skilled roentgenologist, a definite diagnosis of ulcer can be relied upon. A negative roentgen examination with a good history is probably of not much value, for an ulcer may be so situated that it cannot be demonstrated.

The appearance of the duodenal ulcer is less easily influenced by treatment than that of gastric ulcer, but the recent conception of the "fleck" ulcer is significant. The patients have had characteristic symptoms of an active ulcer, though the duodenal cap had filled completely and well. Removal of the barium sulphate revealed typical ulcer craters. At subsequent examinations, a deformity might appear and later disappear, only to return again. Yet this defect, obviously due to spasm, has the same appearance as those deformities attributed to scar tissue. Of the patients in this series who had the usual deformity due to duodenal ulcer, a roentgen examination had been made in 67 after treatment (both medical and surgical), and only 5 (or 7 per cent) have shown a return to normal It is hard to believe that the rest were cured, since there were persistent roentgen changes; it is easier to feel that those 5 will later show similar pathological changes.

The cases of this series were collected from the records of the Peter Bent Brigham Hospital, and include both medical and surgical cases. —*R. S. Bromer.*

Engelmann, Guido. A case of osteopathia hyperostotica (sclerotisans) multiplex infantilis. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1101–1106.

A case of a peculiar affection of the bones is described in a boy eight years of age who complained for a period of over four years of pain with limited function of all extremities. The lesion which is called osteopathia hyperostotica (sclerotisans) multiplex infantilis is characterized by (1) a thickening and hyperostosis of the shafts; (2) sclerosis; (3) increase in length, and (4) deformities of the bones. The condition occurs in association with blood changes (anemia, relative increase of lymphocytes, monocytes and eosinophiles), and therefore the additional name of "haematogenes" is suggested.

Differential diagnosis includes trophic disturbances (especially rickets), osteosclerosis infantilis generalisata fragilis (Laurell and Wallgren), marble bones (Albers-Schönberg), melorheostosis (Léri and Joanny), generalized osteitis fibrosa, osteitis deformans Paget, symmetrical hereditary osteitis (Camurati), Spieler's osteopathy, chronic osteomyelitis and hereditary luetic sclerosing osteitis.—*T. Leucutia.*

Eugster, A. The normalization of the exposure technique in roentgen diagnosis. *Schweizer. med. Wchnschr.*, April 20, 1929, lix, 426–433.

The following factors are important for the standardization of the exposure technique in roentgen diagnosis:

Group I. (1) Tension (kv.) (hardness and quality of rays); (2) current (ma.) (intensity of rays); (3) time of exposure; (4) characteristic of the current curve.

Group II. (1) Object (thickness and quality of absorbing and diffusing medium); (2) focus film distance (conditions of geometric projection); (3) tube (fine or broad focus tube; low or high milliamperage tube; Coolidge or gas tube); (4) intensifying screens (exposure with or without intensifying screen, differences of qualities); (5) elimination of secondary radiation (Potter-Bucky diaphragm); (6) diaphragm compression.

Group III. (1) Film or plate, etc.; (2) developer; (3) temperature of developer; (4) time of developing; (5) fixation, etc. If the factors of Groups II and III are kept more or less constant the normalization of the roentgenographic exposures is limited to the factors of Group I. Of these again the tension and the type of current curve are the most important.

In analyzing the different methods for the measurement of the tension, the author arrived at the conclusion that the sphere gap (with spheres of 12.5 cm.) is the most reliable method (if the necessary corrections are made for the changes in temperature and atmospheric pressure). In using the sphere gap for the different current curves the following are the results of the investigations: (1) The current curves of the induction apparatus, since these machines are now practically abandoned, are not considered. (2) The current curves of continuous or rectified apparatus (mechanical and kenetron rectification) which are the currents almost universally employed can be easily measured by the sphere gap. In the kenetron rectification, however, it is advised to place resistances (water tube resistances) in series with the gap so as to reduce the intensity of the current during the jumping of the current across the gap. This is necessary in order to protect the apparatus, especially the kenetron tubes, from damage during the measurement. (3) The current curves of the alternating current or half wave apparatus can be measured by the sphere gap only after inserting a valve tube in the line and after making certain corrections.

It is the author's opinion that by making use of the sphere gap and by taking into consideration the factors mentioned in the three groups a normalization of the technique can be obtained.—*T. Leucutia.*

Ginsburg, Solomon. Thyrotoxicosis in childhood. Early diagnosis and radium therapy. *Am. J. Dis. Child.*, May, 1929, xxxvii, 923–943.

Ginsburg reviews the literature of exophthalmic goiter in childhood, which conveys in the published articles up to the end of the 19th century, a rather vivid and graphic impression of the excessive rarity of exophthalmic goiter in children. The later articles, however, no longer agree with this impression, and within the last decade and a half, the number of cases recorded has been considerably on the increase, 121 cases having been reported by three observers alone.

Although exophthalmic goiter in childhood is a decidedly less frequent occurrence than in adult life, the numerous case reports furnish incontestible evidence that except for minor variations the clinical manifestations in children are essentially the same as those in adults. Only choreiform movements have been noted more frequently in children than in older patients. These choreiform movements differ from classic choreic movements by being purposeful. Mild and moderately severe types have been observed as very severe forms with fatal issue. As in adults, not all children who withstand even the severer onslaught

of the disease recover completely spontaneously or even after medical therapy. Surgical intervention gradually began to gain favorable notice as a therapeutic measure. From the collected operative cases, Ginsburg concludes that surgical intervention, even the most expert, fortified by preoperative medication with iodine, carries with it a mortality rate in exophthalmic goiter, and he is thoroughly convinced that operation is not the only successful method of local attack on the thyroid gland in its treatment. He states that he has had ample opportunity to be convinced that in radium therapy there is a safe, efficient, bloodless agent that can yield as brilliant results as surgical intervention, without its attendant mortality.

Six cases are reported, all of which showed improvement under radium therapy.

Thyrotoxicosis in childhood may run an acute course with fatal issue, though it is generally milder and therefore more atypical in its manifestations than in the adult. Although the classic type with fully developed cardinal signs presents no difficulty in diagnosis, the atypical forms, especially those with low metabolic rates, do present great diagnostic difficulty at times. When the clinical symptoms and signs, supplemented by laboratory studies are not decisive in differentiating a simple from a toxic goiter, the iodine and the radium therapeutic diagnostic test may be helpful in eliciting a correct diagnosis.—*R. S. Bromer.*

Greensfelder, Louis A., and Hiller, Robert I. Caecal diverticulosis, with special reference to traumatic diverticula. *Surg., Gynec. & Obst.*, June, 1929, xlviii, 786–795.

The authors define two types of solitary acquired diverticula of the cecum, primary and secondary. The secondary or traumatic type arises as a result of some operative procedure in the right lower quadrant, whereas the primary type arises independently of such manipulation.

In only one case of those reported, are the roentgen findings reported. Roentgenoscopic examination revealed what appeared to be an appendix or at least a very large stump that could be visualized and was exquisitely tender to palpation. It was seen better at forty-eight hours after the bismuth meal than at twenty-four. The roentgenographic examination, an illustration of which is reproduced, confirmed the roentgenoscopic findings. What appeared to be a partially filled appendix could be seen lying along the medial aspect of the cecum. Operation showed a diverticulum of the cecum away from the site of the appendix which had been removed at operation twenty-five years before, which was apparently caused by the eversion of the cecum between two constricting strands of omentum.

Summary. Solitary cecal diverticula may produce symptoms of acute or chronic appendicitis necessitating operation. Their presence should be suspected if appendectomy has previously been performed and symptoms recur.

The etiology of the primary type of diverticulum is still a matter of conjecture.

An extensive study covering observations on 5385 major operations and 400 adult necropsies at the Michael Reese Hospital, has yielded 4 cases of traumatic solitary cecal diverticulum, 2 at operation and 2 at autopsy.

Illustrations are presented to demonstrate etiological factors and possibilities in the formation of these diverticula: (*a*) eversion of the cecum between constricting adhesive bands; (*b*) traction of narrow adhesion; (*c*) eversion at the stump site as a result of weakness due to the migration of a silk purse string into the cecum, and (*d*) eversion at the stump site as a result of weakness following the rupture of a stump abscess into the lumen of the bowel.—*R. S. Bromer.*

Hanson, Robert. Some roentgen studies on the normal back during the period of development. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1079–1084.

In 1920, Scheuermann described a condition (so-called kyphosis dorsalis juvenilis) which is characterized by changes in form and structure of the dorsal spine due to an ossification disturbance in the zones between the bodies and epiphyses of the vertebrae. Haglund and Mau described similar disturbances of the ossification zones in scoliosis.

The author undertook a series of investigations in order to determine whether any ossification abnormalities of the spine could be detected in normal children. The investigations are not completed as yet but it can already be said that a number of the vertebrae (in these normal children) show roentgenographic images which can be interpreted as more or less characteristic of some pathological process. Such images are, for example, the cuneiform shape of some of the vertebral bodies (similar to chondrodystrophia), the appearance of calcifications at the margins of the vertebral bodies in the form of parrot beak, the angulation of the bodies of the vertebrae, etc.

From this the author deduces that the spondylitis deformans of adults might originate from an ossification disturbance of childhood

such as observed above and described by Scheuermann in the formation of kyphosis dorsalis juvenilis. Eleven beautiful roentgenograms of the spine are presented.—*T. Leucutia.*

HARDMAN, T. GARRATT. Cholecystography. An analysis of 137 cases showing the reliability of the oral method. *Brit. M. J.*, March 9, 1929, i, 437–439.

Inquiries by colleagues as to the reliability of the Graham-Cole test stimulated the author to report his experience with this procedure. The early history of the roentgenology of the gall-bladder is given. In the early days, direct visualization of the gall-bladder or of stones yielded correct diagnosis in 37 per cent of the cases. Cole, in 1915, called attention to the secondary manifestations of gall-bladder pathology as determined by the opaque meal. Graham, Cole and Copher announced their success in demonstrating the gall-bladder roentgenologically by the intravenous injection of tetrabromphenolphthalein in February, 1924.

The theory of cholecystography is briefly outlined and the technique of intravenous administration of the dye is given.

There is a dissertation on the interpretation of cholecystograms, the detection of gall-stones by the "negative," "positive" and "ring" shadows. Some stones are of such density as to give rise to neither "positive" nor "negative" shadows and would be missed by any method of examination.

In 1925, Whitaker and Milliken reported the good results obtained with the oral method of administration of the dye. This is the method used by the author, who states that in his country it has largely replaced the intravenous method.

An outline of the oral technique used by the author is given. Then an analysis of 137 cases follows in which the test was used. Of this number 64 patients came to operation. In 60 cases, the roentgenological diagnosis was correct—reliability of test 93 per cent. Total cases reported pathological, with or without stones, 89. Of the 52 cases operated on, there was a correct diagnosis in 51—a percentage of 98.

The author concludes that the oral method of the Graham-Cole test possesses a reliability of 93 per cent; that with the exception of the visualization of stones it does not render a precise diagnosis possible and where the gall-bladder is not properly shown by the dye one is only justified in reporting a pathological gall-bladder, and that successful use of the method is dependent upon careful attention to details in conducting the test.—*Karl Kornblum.*

HERMAN, LEON, and GREENE, LLOYD B. The diagnosis of primary neoplasms of the renal pelvis. *Ann. Surg.*, May, 1929, lxxxix, 682–708.

Seven cases of intrapelvic tumors are reported. Ewing has classified tumors of the renal pelvis as: (*a*) benign papilloma, (*b*) papillary epithelioma and (*c*) flat or alveolar carcinoma. All papillary tumors are regarded as inherently malignant.

The flat or non-papillary carcinomata form a small and very malignant group of intrapelvic tumors. One of the 7 cases reported was of this type. These tumors arise from the transitional epithelium and are referred to as squamous cell epithelioma. Chronic irritation such as infection and stones appears to be an important etiologic factor.

Early dissemination of tumor cells before clinical manifestation of the condition is one of the characteristics of non-papillary carcinomata. By the time the diagnosis is manifest the case is inoperable. The operative results have therefore been unsatisfactory and justify the conclusion that non-papillary carcinoma of the kidney is a fatal disease. That the diagnosis is difficult or impossible is apparent from the statement that, "No one, as far as we know, has succeeded in making the correct diagnosis of non-papillary tumor of the renal pelvis."

Papillary tumors are less malignant than the non-papillary variety. They are prone to give rise to tumor implants in the ureter and bladder which are said not to occur in the non-papillary tumors. Early and massive hematuria without renal enlargement is suggestive of a papillary tumor. Urography is regarded as the only dependable means of diagnosing these new growths, and differential diagnosis is largely dependent upon this procedure. Gross hematuria and a large kidney usually mean hypernephroma. A papillary growth in the bladder plus unilateral hematuria or a closed kidney should suggest papillary tumor of the renal pelvis. The presence of infection or stone does not exclude an intrapelvic tumor and a massive hemorrhage with stone should suggest the possibility of such a tumor. Early cases of renal tuberculosis may be difficult to differentiate from papillary tumor and may depend upon the demonstration of cavitation in the apices of the pyramids. Intrapelvic tumors may or may not diminish renal function, thus making differentiation from essential hematuria difficult.

The pyelographic findings indicative of

intrapelvic tumors are an irregular defect in the kidney pelvis, dilatation of some of the calyces, usually the superior, or obliteration of one or more calyces. There is no elongation or narrowing of calyces as in hypernephroma. Where the tumor is of such size as to almost completely fill the pelvis and calyces the pyelogram will show small irregular patches and streaks. Tumors at the uretero-pelvic junction in addition to the pelvic defect will give rise to a hydronephrosis. Where there is complete obstruction, pyelography is not possible.—*Karl Kornblum.*

Hesse. The value of roentgenography in otology. *Deutsche med. Wchnschr.*, May 31, 1929, lv, 911–912.

Wittmaack described four types of pneumatization of the mastoid process: (1) normal pneumatization; (2) irregular pneumatization with cells of various sizes (small and large cells intermingling); (3) small cell pneumatization, and (4) compact mastoid process (without pneumatization). In analyzing the occurrence of the different infections in the four types of pneumatization it was found that acute otitis media is observed chiefly in types 2 and 3, while type 4 always leads to a chronic form of otitis media.

The roentgenologic findings in the different types of middle ear inflammations are as follows: (*a*) in acute middle ear inflammation there is a slight clouding of the cells of the mastoid process which may clear up or may lead to a breaking down of the cells. Check-up roentgenograms taken at different intervals will give information as to whether antrotomy is indicated; (*b*) in subacute middle ear inflammation there is a rather diffuse infiltration of all the cells. Since the clinical symptomatology here is often very slight or nil, roentgenograms are of great value; (*c*) in chronic middle ear inflammations there is almost invariably a compact, sclerotic mastoid process in the roentgenograms. In cholesteatomas the roentgen examination gives information with regard to the extent of the lesion. It was tried to inject iodipin in order to visualize the cavities of the cholesteatoma; however this has only a limited value.

A systematic roentgen examination of the mastoid process in all conditions of the middle ear coming to operation is of value also because (*a*) it gives accurate information as regards the extent of the pneumatization and (*b*) it indicates the exact course of the sigmoid sinus. —*T. Leucutia.*

Hofer, R. The sulcus paraglenoidalis of the os ilium and os sacrum in the roentgenogram. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1085–1088.

Two cases of sulcus paraglenoidalis of the os ilium and one case of sulcus paraglenoidalis of the os sacrum are described and their roentgenograms presented. The condition is then compared with roentgenograms taken on a skeleton showing a similar sulcus formation.

In analyzing the incidence of this anatomical abnormality the authors found that in certain races it is rather common. An investigation of 139 male and 70 female Hollanders revealed that the sulcus paraglenoidalis of the os ilium occurs in 23 per cent of all men and in 87.1 per cent of all women, while the sulcus paraglenoidalis of the os sacrum occurs in 1.4 per cent of the men and in 14.2 per cent of the women. A similar frequency of both the sulcus paraglenoidalis of the os ilium and os sacrum was observed in women of Java, Japan, Aino and Greenland.

A differentiation from exostosis of the lower part of the sacroiliac articulation is as a rule easily accomplished.—*T. Leucutia.*

Jaksch-Wartenhorst, R. Pseudocysticercosis simulating lung tuberculosis. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1116.

In 1923 the author described a case of lung cysticercosis in a girl twenty-three years of age who since then died. The autopsy revealed the presence of tuberculosis of the lungs. The possibility of confusing tuberculosis with cysticercosis is mentioned on account of the recent publication of Hecker and Kellner who described a similar case.—*T. Leucutia.*

Kienböck, R., and Mayer, E. G. A case of echinococcosis of the pelvic bones. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1026–1034.

The authors describe a very interesting case of echinococcosis of the right pelvic bones lasting for a period of over fifty-five years. The condition occurred in a physician, fifty-nine years of age, who had had definite symptomatology in connection with the right hip since three years old. Until the age of fifty, however, there was little functional disturbance and the patient was able to run and ride a bicycle without much trouble. For the last eight years the condition has become gradually worse, and the first roentgenogram of the pelvis taken in 1924 showed a lesion which was diagnosed as an osteogenic sarcoma. The roentgenogram taken recently (four years later) revealed a very marked destruction of the bones of the right pelvis with caving in of the head of the femur

and with partial destruction of the upper end of the femur. There was evidence of cystic formations and this, together with the long history, as well as the physical examination of the case made the diagnosis of echinococcosis certain. The case is unique and is therefore presented in great detail.—*T. Leucutia.*

KIENLIN, H., and KREMSER, K. Roentgenologic examinations of the stomach in pregnancy, especially in hyperemesis gravidarum. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1094–1098.

The roentgenologic appearance of the stomach in late pregnancy is well known.

In a first series of investigations the author examined the appearance of the stomach in 9 cases of early pregnancy (from two to four months) and found that there is no deviation from the normal.

In a second series of investigations, 18 cases of hyperemesis gravidarum were examined and it was found that the disturbances in the motility of the stomach are so slight that they have no practical significance. Only in a very few instances was there evidence of a spasm of the pylorus and evidence of hypertonicity.

Since the examination was entirely negative for evidence of irritability of the stomach, it is probable that the cause of hyperemesis gravidarum lies in a hyperexcitability of the vegetative nervous system. This theory is supported also by the strong susceptibility of these cases to psychic influences.—*T. Leucutia.*

KLOIBER, HANS, and STROOMANN, GERHARD. The roentgen picture of the aging heart. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 993–1015.

The author undertook a series of investigations on 220 inmates (113 men and 107 women) of the Kreispflegeanstalt Hub (Baden and Karlsruhe) between the ages of thirty and seventy-five, in order to determine the changes of the heart incidental to old age and in relation to the height, weight, blood pressure and diameter of the chest (heart-lung coefficient). Through a very accurate physical examination only persons within the normal limits were chosen for the investigation.

The procedure of the roentgenologic examination consisted first, in roentgenoscopy and second, in teleroentgenography (at 2 meter distance).

It was found that there is a gradual increase of the transverse and longitudinal diameters of the heart with increasing age. This is somewhat more pronounced in women than in men. There was practically no or only little increase in the median right (of the transverse diameter), while the median left showed considerable increase indicating that the enlargement due to age is confined exclusively to the left ventricle of the heart.

In analyzing the changes of the aging heart in relationship to the height of the individual it was found that the taller the person, the larger the transverse diameter. However, the enlargement here is confined chiefly to the median right, and the changes are more pronounced in men than in women.

As regards the relation to weight and blood pressure the enlargement is confined chiefly to the median left and this is very marked in women (probably due to disturbances of internal secretion as a result of cessation of ovarian function).

Following Groedel's investigations on the valûe of the heart-lung coefficient, the author found this to be of considerable importance also in old age. Thus the coefficient in men was between 1.97 and 1.94 and in women between 1.96 and 1.90, which indicates that the heart, in comparison to the width of the lungs, slowly but gradually increases in size. The heart-lung coefficient proportionately increases with weight and blood pressure and decreases with height.

The author further calls attention to the fact that both the relation of MR:ML and the heart-lung coefficient can be better estimated by considering the angle of inclination of the heart (cardiodiaphragmatic angle). It was found that while the angle of inclination decreases with age (in men from 37° to 30°; in women from 39° to 32°) and weight, it increases with height. The MR:ML relation for the different angles of inclination is as follows: 2.26 for 26°; 2.05 for 33° and 1.94 for 42° in men; while in women the values are 2.33, 2.24 and 1.93 respectively. The heart-lung coefficient for the same angles is 1.92, 1.95 and 2.03 in men, and 1.89, 1.96 and 1.98 in women (indicating that a decrease in the angle of inclination results in a like decrease of the heart-lung coefficient). The smaller heart-lung coefficient in women is due to the fact that the heart increases to a greater extent in relation to the lung width than in men, no doubt as a result of the higher diaphragm, smaller thoracic cavity and a greater increase in the blood pressure.—*T. Leucutia.*

MANGES, WILLIS F. Roentgen observations on safety-pins as foreign bodies. *Arch. Otolaryngol.*, March, 1929, ix, 245–250.

The safety pin causes approximately 12 per cent of the foreign body work in Dr. Chevalier Jackson's series of cases from the bronchoscopic clinic of the Jefferson Hospital.

The function of the roentgenologist is mainly diagnostic. This involves not only the actual diagnosis of the presence or absence of the foreign body, but in cases where the pin is present, a description of its parts, its physical characteristics and conditions, its effect upon surrounding tissues, the variation of its progress from day to day when it is not immediately removed, and the anatomic characteristics of the patient. After the pin has been removed, roentgenograms should show its absence and the condition of the patient. On occasions the two plane roentgenoscope is of assistance in removing the foreign body. Instrumentation should not be resorted to without the positive information the roentgenogram can give.

Clinical study is insufficient in the absence of positive history. Roentgen diagnosis should not be depended upon unless the study includes the entire area of the respiratory and alimentary tracts, after all clothing and other possible containers of foreign bodies have been removed. Emergency measures are important in the presence of dangerous symptoms.

Most types of foreign bodies have a tendency to lodge in some special part of the body. For instance, the peanut kernel in the bronchus, or occasionally in the trachea, the common pin penetrates into the depths of the lungs, the majority of coins are found at the level of the esophagus, but the safety pin may lodge in any portion of the alimentary or respiratory tracts. Above the level of the larynx, the question of differential diagnosis does not enter; below this level, the foreign body must be localized more specifically. Almost always, a safety pin in the larynx or trachea is placed with its two branches in the sagittal plane, regardless of whether it is closed or open. Roentgenograms should always be of such quality as to show the shadows of the larynx and the trachea in sharp detail, both anteroposteriorly and laterally. A little bismuth and water may be necessary to locate the pin if it is at the level of the bifurcation of the trachea or a little below it. The air shadow of the stomach helps to localize the pin if seen in the region of the stomach.

To determine the size of a safety pin a roentgenogram must be made at a distance of 36 inches (91.44 cm.) or more and the pin must be parallel to the film. This can be compared with other pins put in contact with the shadow. The distribution of its parts may be most variable. A defective pin may sometimes be recognized which may influence the method of removal.

Roentgen examination will show mediastinal changes due to infection from previous faulty technique. An enlarged thymus may be present. Other intrathoracic changes may also be diagnosed if present.

On the roentgenologist depends the roentgen technique, danger from over-exposure, etc. He must know whether the point of the pin is sheathed or trailing before pressure is made by the bronchoscopist. He is not responsible for failures or accidents over which the bronchoscopist has control.—*R. S. Bromer.*

Mohler, Henry K. Acute massive (nonsurgical, nontraumatic) pulmonary atelectasis. *Am. J. M. Sc.*, April, 1929, clxxvii, 507–513.

The author states that although internists have seen and recognized acute massive pulmonary atelectasis as a definite clinical entity in surgical patients, it would appear from the literature that, except to state that it occurs in purely medical conditions, relatively few have described its actual occurrence. He reviews cases previously reported, discusses the etiology of the condition, its symptoms, physical signs, diagnosis, differential diagnosis, prognosis, and reports 2 cases. His conclusions are:

1. The occurrence of pulmonary atelectasis is reported in a case of pneumonia and in one of cancer of the stomach.

2. Pulmonary atelectasis occurs more frequently than is generally recognized in association with nonsurgical and nontraumatic cases.

3. It is a definite clinical entity and readily diagnosed by its physical signs and clinical course.

4. Until more conclusive evidence is presented, the mechanical obstruction theory as to etiology is the most plausible since removal of the obstruction has resulted in prompt expansion of the lung. Experimentally the condition has been reproduced in animals by the injection into their bronchi of material removed from the bronchi of patients suffering from pulmonary atelectasis. The abolition of the cough reflex in dogs followed by the introduction of an acacia solution into their bronchi has produced pulmonary atelectasis which disappeared when the acacia solution was aspirated through the bronchoscope.—*R. S. Bromer.*

Ongkiehong, H. F. On a unilateral congenital deformity of the os naviculare pedis. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1117–1118.

Following the discovery by Köhler in 1908 of a peculiar disease of the navicular bone in the young, called since then Köhler's disease, a

voluminous literature has been written on the subject. Several new subvarieties were described and classed as distinct entities. Thus Müller separated a form with involvement of the navicular bone on both feet, Blencke a form leading to synostosis between the talus and navicular bone, etc.

The author describes a case of unilateral congenital deformity of the navicular bone associated with deformity of the talus and calcaneus which later resulted in a dislocation of the navicular bone (on the dorsal surface of the foot) and formation of an articulation between the navicular bone and calcaneus. There was also a flat foot of moderate degree. This condition is likewise considered a distinct entity.—*T. Leucutia.*

Pape, Rudolf. On the differential diagnosis of tabetic vertebral changes. *Fortschr. a. d. Geb. d. Röentgenstrahlen*, June, 1929, xxxix, 1066–1078.

Six cases of changes of the spinal column were observed in the Central Roentgen Institute in Vienna which were roentgenologically diagnosed as tabes. Four of the cases were definitely verified as tabetic conditions, while one proved to be tuberculosis and in the sixth a differentiation between tabes and trauma could not be made.

On the basis of the cases observed and those collected from the literature, the author divides tabetic lesions of the spine from the point of view of differential diagnosis into the following four groups: (1) Atrophic forms without localized areas of destruction. Differential diagnosis includes senility, malacia, scurvy, rickets, and trophoneurotic atrophy (paralysis, poliomyelitis, psoriasis, syringomyelia, etc.). (2) Atrophic formations with localized areas of destruction, spontaneous fractures and luxations. Differential diagnosis includes tuberculosis, acute infectious spondylitis (Fraenkel), malacia (Eisler and Hass), Kummel's disease, osteolysis, metastatic tumors, etc. (3) Hypertrophic forms with exostosis and sclerosis in addition to areas of destruction. Differential diagnosis includes arthritis deformans, tuberculosis, chronic recurrent osteomyelitis, syphilis, actinomycosis, osteitis deformans Paget, osteitis fibrocystica Recklinghausen, trauma and echinococcus cyst. (4) Hypertrophic forms with paravertebral calcifications. Differential diagnosis includes especially tuberculosis, less frequently infectious osteomyelitis, actinomycosis and trauma.—*T. Leucutia.*

Pohl, Rudolf. A case of cavernous hemangioma of the tibia. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1099–1100.

A case of cavernous hemangioma of the tibia is described in a patient fifty-six years of age and the roentgenogram is presented. The condition is extremely rare.—*T. Leucutia.*

Popović. Remarks on pneumothorax. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1106–1109.

Reference is made to the phenomenon of deglutition in pneumothorax which consists in an up-and-down movement of the collapsed lung during the act of deglutition. This phenomenon is explained by the pull which is exercised on the roots of the lungs by the upward moving larynx and trachea at the close of the epiglottis during deglutition. In case of partial or complete adhesions there is limited or entire lack of motion of the lung. —*T. Leucutia.*

Salinger, Hans. On Looser's metaplastic zones, with special consideration of their occurrence in osteodystrophia fibrosa. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1049–1059.

Looser, in 1920, in his work on late rickets and osteomalacia describes zones of rarefaction (similar to incomplete fractures) which result from replacement of the normal ossification by connective tissue formation. The zones occur especially at the points of greatest weight bearing, they are of from a few millimeters to 2 cm. wide and are often surrounded by thin areas of callus formation. Histologically they represent a lacunar absorption of the lamellar bone followed by fibrous, calcium-free bone formation.

The author describes two similar cases in which the rarefying zones appeared in several of the bones (pelvis, femora, tibiae, etc.). In one of the cases following antirachitic treatment there was clinical and roentgenological healing.

In three further cases the zones of rarefaction occurred in connection with osteodystrophia fibrosa. In one of the cases the zones were verified at the postmortem examination. —*T. Leucutia.*

Santozki, M., and Kopelmann, S. A contribution to the so-called malacia of the os lunatum and os naviculare (Kienböck-Preiser's disease). *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1060–1066.

Twenty cases of malacia (15 of the os lunatum and 5 of the os naviculare) were collected by

the authors. The cases are presented in a tabulated form.

Clinically three stages of development are differentiated: (1) stage of irritation setting in immediately following trauma and lasting for a period of from one day to two weeks; (2) stage of lack of symptomatology lasting for a period of months or years, and (3) stage of full development of the disease (swelling of the hand joint, pain, impaired function, loss of force, Finsterer's "a" and "b" symptom-complex).

Based on the roentgenological and histo-pathological appearance the following four stages are described: (1) roentgenologically, normal appearance; histo-pathologically, primary subchondral bone necrosis; (2) roentgenologically, thickening and rarefaction of the bony structure with maintenance of normal form (no fracture) and occasionally sequestrum formation; histo-pathologically, fractures of the necrotic bone trabeculae with intact bony shaft; (3) roentgenologically, bone deformity with unevenness of structure, zones of increased and decreased opacity, and pathological fracture; histo-pathologically, layers of granulation tissue with osteoclasts and osteoblasts around the necrotic bony foci, fibrotic bone marrow (resorption of the necrotic bone substance and bone new formation); (4) roentgenologically, reappearance of the normal structure leading to complete restitution but with marked deformities, later, of the arthritis deformans type; histo-pathologically, restoration of the bone (formation of spongiosa trabeculae with calcium deposit) and changes of the cartilage resulting in arthritis deformans.

According to Kienböck and Preiser, the condition is the result of a traumatic injury of the ligaments with rupture of the blood vessels supplying the bone, while according to other investigators it is a simple compression fracture with consecutive necrosis of the fragments. In the authors' estimation the inciting cause is a chronic (occupational) trauma leading to a tension of the joint capsule, with injury to the blood vessels. The impaired blood supply in turn gives rise to a gradual thickening of the capsule with secondary obliteration of the lumen of the blood vessels (endarteritis obliterans) and finally malacia and necrosis of the bones involved.

The treatment consists in early surgical intervention.—*T. Leucutia.*

Schnek, Fritz. On the etiology, treatment and prevention of the so-called post-traumatic navicular cyst. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1929, xxxix, 1016–1025.

Preiser, in 1910, described 5 cases (out of a total of 24 cases of fractures of the os naviculare) which later resulted in "rarefying osteitis' of the navicular bone, due in his estimation to traumatism of the blood vessels supplying the bone. The condition has since then been called in honor of its discoverer "Preiser's disease."

The author in reopening the subject publishes his own investigations on 60 cases of fractures of the navicular bone observed during the past three years, 11 of which resulted in cystic formations such as described by Preiser. Of the 11 cases, 8 (one bilateral) were successfully treated by application of a posterior plaster mold for a longer period (six to seven months) while 3 cases refused treatment.

The opinion is expressed: (1) that post-traumatic navicular cyst is the result of a fracture of the navicular bone (which either was not recognized or was not properly treated at the beginning) and not a pseudarthrosis; (2) that a complete healing may be obtained by fixation lasting over a period of several months (the treatment being identical to that of a fracture of the os naviculare); (3) that the prognosis of a fresh fracture of the os naviculare under proper treatment is as high as 100 per cent, and (4) that the development of a post-traumatic nutritional disturbance can be prevented in all cases of hand injuries.—*T. Leucutia.*

Schöndube, W. Further roentgenological contributions to the mechanism of emptying of the gall-bladder. A new combined roentgen examination of the function of the stomach and gall-bladder. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, xxxix, 865–871.

In a former article the author presented a series of cholecystograms proving that there is active emptying of the gall-bladder following administration of oil or egg yolks. In the present article the results of further investigations (in 2 cases) are given which show that peristalsis plays no part in the emptying of the gall-bladder but that this is due to the digestive stimuli of the egg yolks, oil, or other fat-rich substances.

The investigations were carried out as follows: First 3.5 iodtetragnost was intravenously injected in a case with normal gall-bladder (according to the routine procedure). The day following the intravenous injection the usual barium meal was given and the emptying of the gall-bladder observed. It was found that the peristalsis of the stomach

remained without influence on the emptying time but as soon as egg yolks were administered a rapid emptying of the gall-bladder ensued. In a second case the barium meal and the egg yolks were given simultaneously and a rapid emptying of the gall-bladder (such as is observed in Boyden's meal) was observed.

The conclusion is therefore reached that peristalsis of the gastrointestinal tract is without influence on the emptying of the gall-bladder and that digestive, chemical and hormonal stimuli are necessary to produce the emptying.—*T. Leucutia.*

Statham, R. S. Hystero-salpingography in the diagnosis and treatment of sterility and pelvic disease. *Brit. M. J.*, May 25, 1929, i, 947–950.

The author gives a brief history of the method of diagnosis in which Carey, Dimier, Rubin, and Kennedy were named as early workers. Heuser and Carelli, during 1924 and 1925, had good results for the first time following the injection of lipiodol. The discovery of the suitability of lipiodol resulted in enthusiastic use of this method of diagnosis on the continent and in America. Béclère has written a monograph on the subject.

The technique. It is important to make the test at least one week before the beginning or from the end of a menstrual period. Pregnancy, purulent cervicitis, and active salpingitis are contraindications. A general anesthetic is used only for nulliparae and very nervous patients. In many cases, a small dose of morphine and scopolamine are of great assistance. The author describes in detail a special syringe, manometer, and nozzle which he uses. He uses a 25 cc. syringe with a manometer attached to measure the pressure, and a three-way stopcock which permits refilling of the syringe, if necessary. He uses a short, blunt nozzle with a tapered tip which permits a tight fit in cases of lacerated cervix. The syringe and nozzle are filled with lipiodol at blood heat. The patient is placed on her back, on the horizontal roentgenoscope, her legs are raised, and the cervix is caught with a bullet forceps vulsellum, and the cervix and os are swabbed with iodine. The nozzle is inserted into the cervix and kept in place by pull on the vulsellum and pressure on the syringe. This causes very little discomfort to the conscious patient. The legs are now placed flat.

Visualization of the Fallopian tubes is difficult with the roentgenoscope, and good accommodation is necessary before starting this examination. The roentgenoscopic examination is started and after localizing the nozzle, 5 cc. of lipiodol is injected and the triangular uterine cavity is seen. The injection is continued, watching the pressure, and after a short delay the tubes begin to fill. The tubes normally fill quickly and lipiodol is seen forming a collection in the peritoneal cavity. If the tubes are obstructed, this process is seen to a greater or lesser degree on either side, or no lipiodol may enter. The pressure between 180 and 250 mm. will cause pain, and it should not be permitted to rise above 250 mm.

The first roentgenogram is taken when the tubes are filled, or when the pressure reaches 250 mm. The patient is now turned on her side and a lateral view is taken. This completes the procedure. After a short rest, the patient is permitted to return home. Another roentgenogram is taken twenty-four hours later.

The Potter-Bucky diaphragm produces beautiful roentgenograms, but is difficult to use on the horizontal roentgenoscope, and films made without the Potter-Bucky diaphragm are of sufficient diagnostic quality.

The advantages of the operation are both diagnostic and curative. Lipiodol is superior to CO_2: (1) because it demonstrates the exact site of tubal obstruction; (2) it will demonstrate that a uterus is not pregnant; (3) it will show the pressure of intrauterine growths; (4) it gives a good idea of the ease or difficulty of an intended myomectomy, and (5) it will decide whether a pelvic tumor is of gynecological nature or not.

The author feels that heavy, oily lipiodol is a better clearer of the so-called "sticky tube" than is gas, and he states that in many cases, lipiodol did not pass through the tubes until a pressure of 180 or 200 mm. was registered. The author feels this has overcome sterility in 4 of his cases. The article contains seven illustrations; three of a normal uterus and tubes filled with lipiodol, and four demonstrating pathology in either the uterus or tubes.—*E. P. Pendergrass.*

Stone, William S., and Craver, Lloyd F. The biological effects of the x-ray and radium as an aid in the diagnosis of neoplastic diseases. *Ann. Surg.*, Feb., 1929, lxxxix, 176–182.

The accumulated experience of radiation in neoplastic diseases is making possible the differential diagnosis of such diseases by means of their response to roentgen and radium radiation. Thus many tumors are now recognized as being either radiosensitive or radioresistant. A histologic study of tumors designated as radiosensitive has shown them to be very cellular with little or no supporting stroma.

The tendency of metastatic lesions to show

an increase in cellular structure is responsible for the fact that such lesions respond more readily to radiation than do the primary tumors.

Among the radiosensitive tumors that are now recognized as such are Wilms's tumor of the kidney, certain mediastinal tumors, endothelial myeloma or Ewing's tumor and the so-called transitional cell carcinoma. The radiosensitiveness of these tumors is now regarded as one of their clinical characteristics.

On the basis of their favorable response to irradiation Cutler has been able to isolate a group of tumors of the mouth which on pathological studies revealed a common histological structure. These transitional cell carcinomas are also found in the larynx, esophagus, uterus, and other organs.

A warning is sounded against a too wide application of this therapeutic test. Especially is this true in breast tumors, few of which are radiosensitive and which offer exceptional clinical features for their recognition.

A proper evaluation of the biological effect of radiation as a diagnostic aid is dependent upon the recognition of a number of factors which may alter the normal radiation reaction. Among these factors are the presence of radioresistant tissues such as cartilage, bone, cicatricial or fibrotic tissue, local nutritional disturbances, infection, and anemia with or without cachexia.

The use of the roentgen ray and radium as a therapeutic test is of special value in the differential diagnosis of tumors of the lymph nodes of the neck. The reaction of these tumors to radiation is so specific that resort to biopsies has been found unnecessary. The argument against removal of a gland from the neck for the purpose of biopsy is that infection so frequently follows, that not infrequently growth activity is accelerated and in those cases where the clinical picture is confused or uncertain, the pathologist's report is likewise indefinite. In this connection the authors state: "The diagnosis of the pathologist depends upon his interpretation of the section, but the regression of the tumor requires no such difficult histological interpretion." They do not desire, however, to belittle the value of accurate pathological data where the clinical aspects of the case make such information imperative.

Differential diagnosis between lymphosarcoma, Hodgkin's disease and lymphatic leucemia is made possible by the radiation reaction. A typical lymphosarcoma regresses completely within a few days or weeks, Hodgkin's nodes within a few weeks or months, and not always completely, while the nodes of lymphatic leucemia usually show more resistance and rarely, if ever, is the regression complete. The specific radiation reaction in pseudoleucemia has given weight to the idea that this condition is distinct from Hodgkin's disease.

The therapeutic test rather than the immediate resort to surgery is advocated for tumors of the tonsil in the belief that many of these tumors are lymphosarcomas or possibly transitional cell carcinomas.

In conclusion, the authors state that with certain tumors the reaction to radiation is so marked, so constant, and so specific, as to make this reaction a valuable aid in diagnosis, so that at times, when the microscopic structure is difficult to interpret, the results of radiation may support or alter the histological diagnosis.—*Karl Kornblum.*

Thorpe, Edward S. Chronic bronchiectasis in childhood, with observations on early diagnosis. *Am. J. M. Sc.*, June, 1929, clxxvii, 759–767.

Three types of bronchiectasis have been described in pediatric literature: (1) A congenital form, variously reported as "congenital cystic formation of the lungs" or atelectatic bronchiectasis, which is found rarely in still-born children; (2) an acute type, called "bronchiolectasis" and observed in the terminal bronchioles of marasmic infants; (3) finally, that type—most commonly recognized—which occurs as the result of chronic pulmonary infection. This paper deals only with the latter type. Thorpe selected 53 cases from the records of the Hospital of the University of Pennsylvania and the Children's Hospital of Philadelphia, which he considered demonstrated this condition in children under thirteen years of age, and used these cases as the basis of his conclusions. He excluded cases in which the condition was due to foreign bodies of long residence, though it is conceivable that they very properly might be added to this group. He also excluded cases in which bronchiectasis complicated proven pulmonary tuberculosis.

Summary. 1. The opinion is advanced that this condition is far more common than is usually supposed.

2. Bronchopneumonia, pertussis and measles are the common anteceding factors in the production of bronchiectasis, since they carry infection deep into the framework of the bronchi and the lungs. Disease of the accessory sinuses is thought to be a concomitant factor in maintaining a state of sepsis.

3. An attempt has been made to demonstrate the protean nature of the disease and to

correlate the physical findings with the pathological lesions, especially in the early cases.

4. Evidence has been presented showing the damaging effect of the disease on the nutritional state of the affected children.

5. A rational mode of treatment is outlined, which includes drainage of the pus-filled bronchi, and care of the general health of the patient. Early diagnosis is urged to make more efficient such a therapeutic program.

Thorpe considers the roentgenologic findings of immense diagnostic importance. Usually an affirmative report is based upon the finding of obliteration of the lower right angle of the heart by thickened bronchial trunks which extend like cords to the periphery, and the recognition of impaired diaphragmatic action. Many advanced cases show uniformly increased density of the whole lung due to pleurisy, and can only be diagnosed accurately after the injection of lipiodol. Unilateral involvement was seen in 62 per cent of the cases, but he feels confident that bilateral disease will prove more frequent with wider usage of lipiodol.

The paper is well illustrated with roentgenograms and contains a chart showing a complete analysis of symptoms, physical signs, roentgenologic and bronchoscopic findings in 30 children who were bronchoscoped, and another chart showing an analysis of 23 patients who were not bronchoscoped. The complete paper is well worth reading by every roentgenologist.—*R. S. Bromer.*

Wolfson, William L., and Gray, Irving. Ruptured gastroduodenal ulcer; report of twenty-seven cases. *Ann. Surg.*, Feb., 1929, lxxxix, 264–271.

Early and correct diagnosis of ruptured gastroduodenal ulcer is necessary if proper treatment is to be instituted. The acuteness of the condition prevents the usual studies being made. The characteristic features of these cases are sudden onset when the stomach is full, intense pain in the upper abdomen, vomiting and shock.

Vaughn and Bram have reported 13 cases in which the condition was recognized by the roentgen ray due to the spontaneous pneumoperitoneum produced. Free peritoneal gas demonstrated as early as two hours after perforation; only a small amount of gas required. Best noted with the patient in upright position, but also satisfactorily demonstrated with patient lying on the left side. Shifting of the air bubble with change of posture is important.

Subcutaneous emphysema usually in umbilical and cecal regions has recently been mentioned by Vigyzao as diagnostic of ruptured ulcer.

Obliteration of liver dullness cannot be relied upon in diagnosis. Only a positive finding is of value. Differential diagnosis is at times difficult. A history of a definitely proven ulcer is helpful.

Ruptured gastroduodenal ulcer must be differentiated from:

1. *Gall-bladder Disease.* History of previous attacks relieved by morphine, pain and tenderness localized to gall-bladder region, jaundice, fever, liver enlarged, increased amount of bilirubin in the blood.

2. *Acute Pancreatitis.* Simulates ruptured ulcer very closely. Frequently a past history of gall-bladder disease. Radiation of pain to the left flank or back. Complete collapse, cyanosis and malar flush. Distended abdomen. Occasionally the impression of a wide bar-like mass may be noted in the epigastrium.

3. *Acute Perforated Appendicitis.* Simulation by local and reflex phenomena or undescended cecum with a high appendix. If ruptured ulcer there is often definite and marked pain in the right lower abdomen due to gravitation of gastric contents to that part.

4. *Intestinal Obstruction.* Vomiting, persistent bilious and later fecal. Cramps are rhythmical. Occasionally may palpate a distended loop. Rigidity not so marked.

5. *Diaphragmatic Pleurisy.* History of respiratory infection; present abdominal reflexes, soft abdomen, are important in differential diagnosis.

6. *Renal Colic.* The individual with an attack of renal colic is apt to throw himself restlessly around, whereas in ruptured ulcer, despite the excruciating pain, the individual generally remains quiet. Blood in urine, tenderness in flank, positive Murphy signs and intervals of relief indicate renal colic.

7. *Coronary Artery Thrombosis.* Case of L. L. Hart simulated ruptured ulcer very closely. True diagnosis only revealed at necropsy.

Group of Typical Illustrative Cases. Thirteen in number, ages ranged from twenty-six to fifty-eight, average age forty-two. Four gastric, 9 duodenal ulcers. All had a history of gastric symptoms characteristic of ulcer. A short synopsis of the history of these cases is given.

Atypical Group. Fifteen patients. None had previous gastric disturbance. History and physical findings not those characteristic of ruptured ulcer. Average age thirty-seven.

Ages ranged from twenty to sixty-two. Four gastric, 11 duodenal ulcers. One death. All but one ulcer showed chronic inflammation. In the 28 cases reported in both groups the occupation with one or two exceptions, was that of a laborer or mechanical operator. A short résumé of cases is given.

The authors' comments are that while ruptured gastroduodenal ulcer may occur in the young as well as the old, the greatest frequency is during middle life, the period of greatest physical activity. Almost half their cases were atypical in clinical manifestations. In their series of 28 cases there were 2 deaths. They stress the need of immediate operation. All ulcers except one were chronic. Differential diagnosis presents many problems. Suspected cases should be hospitalized.—*Karl Kornblum.*

Zollschan, J. The etiology of cascade stomach. *Fortschr. a. d. Geb. d. Röntgenstrahlen,* June, 1929, xxxix, 1035–1048.

Rieder, in describing different abnormalities of the stomach, mentions a peculiar atypical form which he calls "cascade stomach" and which consists in the appearance of a pocket giving the impression of a double stomach. The author recently observed 3 such cases and since in all instances an erroneous diagnosis was previously made elsewhere, he deemed it advisable to reopen the subject for discussion.

In the first case, that of a man of middle age with a very good general condition, a diagnosis of ulcerative or possible malignant hour-glass stomach with stenosis was made and operation advised. In the second case, that of a physician, the diagnosis was that of ulcus ventriculi and also operation advised. In the third case the cascade stomach appeared in association with a gall-bladder affection for which likewise a surgical intervention was recommended.

Following the works of Macaigne and Baize and through numerous investigations of his own (on His's cadaver specimens of the Anatomical Institute of Berlin) the author arrived at the conclusion that the formation of a cascade stomach is due to the association of the three following factors: (*a*) abnormal position of the spleen; (*b*) distention of the fundus (aerophagy), and (*c*) loosening of the connective tissue (due to the presence of fat) between the pancreas and kidney leading thus to a pocket formation of the stomach. The condition is therefore the result of anatomical abnormalities and not of pathological processes.

In connection with this, diagrams of borderline cases (between cascade stomach and a pathological condition) are presented and briefly discussed.—*T. Leucutia.*

ROENTGEN AND RADIUM THERAPY

Aschner, B. On the late symptomatology in women following roentgen castration. *Zentralbl. f. Gynäk.,* April 13, 1929, liii, 910–931.

On the basis of 58 cases treated with roentgen castration for different conditions, the author analyzes the symptomatology of late changes with regard to age incidence, site, cause and method of irradiation, heart and vascular manifestations, rheumatic-arthritic-neurologic complaints, nervous and psychic disturbances and findings of the gastrointestinal tract. No final conclusions are drawn as yet.—*T. Leucutia.*

Bell, W. Blair. The present position of lead therapy in malignant disease. *Brit. M. J.,* March 9, 1929, i, 431–437.

Surgery and radiotherapy, which until recently have been the most reliable methods in the treatment of malignancy, have not caused a decrease in the mortality rate due to the fact that cancer is on the increase as the result of the prolongation of life so evident in civilized communities. Biochemotherapeutical methods, in the opinion of the author, offer great promise in combating malignant disease. An example of this form of therapy is the use of lead, the results of which have been sufficiently encouraging to warrant further utilization of this method.

The use of lead to the exclusion of other forms of treatment is not advocated but a sufficient number of cases have now been treated by lead alone to appreciate the fact that the good results obtained in combined therapy are not due entirely to surgery, roentgen rays or radium.

In lead therapy the general condition of the patient is of far more importance than the type or situation of the neoplasm. Contraindications to the use of lead are functional impairment of the liver or kidneys, diseases of the heart and blood, cachexia, acidosis with ketonuria and other constitutional states. So long as the patient is in good condition, with a prospect of about six months of life, if other things are equal, treatment may be contemplated.

The methods of treatment with lead are described. As to dosage, small individual doses are recommended, aiming at a high total, usually 0.5 to 0.8 gm. Among the forms of lead that have been employed are a

suspension of metallic lead and the colloidal preparation of lead phosphate. The method of administration most commonly employed is the intravenous injection. In some cases roentgen rays and radium have been applied four days after the administration of lead. Mobilization of the lead stored in the body is not practised generally for fear of causing its withdrawal from the neoplastic tissue. Lead must be kept in the tissues until the danger of recurrence is long past.

In judging results of lead therapy only those cases in which the treatment has been properly given and in which treatment has been completed should be used for statistical purposes. Also, arrest and alleviation of the disease must equally be taken into account.

The protocols of a representative group of cases are given. These are grouped under the following headings:

(A) Cases in which the primary growth was treated with lead alone.

(B) Treatment of the primary growth by incomplete operation and the subsequent administration of lead.

(C) Cases in which recurrence occurred after removal of the primary neoplasm, and which were subsequently treated with lead.

(D) Treatment of the primary growth by operation and the subsequent administration of lead.

(E) Treatment of primary neoplasm with lead and roentgen rays.

Statistics and results obtained by the use of lead from November, 1920, to November, 1928, are given. The author summarizes these by the statement, "to put our statistics in the worst possible light, we can state that there were 65 successes out of 303 cases treated; that is 21.5 per cent of successful results."

In conclusion, the author emphasizes two points, first, that beneficial results with lead can only be obtained when the method is properly employed. Lead therapy, today, is in much the same position as radium therapy was twenty years ago. We must first learn how to use this agent. The second point is that one must not expect better initial results from this new form of therapy, which is employed usually in the most advanced and hopeless cases, than is now obtained from the long established methods used in early and selected cases.—*Karl Kornblum.*

Bonney, Victor. Results of surgery compared with the results of radium in carcinoma of the cervix. *Lancet*, May 25, 1929, i, 1090–1092.

Up to the end of 1923 the author had performed Wertheim's operation for carcinoma of the cervix on 265 patients out of 420 seen. He had a relative cure of 39.6 per cent and an absolute cure of 25 per cent. Of his series of 265 patients, 42 per cent had gland involvement, and in this group there was a cure of 23.8 per cent. In the other 58 per cent without gland involvement there was a cure of 51.3 per cent.

In comparing the results obtained by radium and surgery, he states that the scope of radium applied in the vagina is not greater than that of surgery because it does not reach the regional glands. It is stated that 40 per cent of all cases presenting themselves to a surgical clinic or to a radium clinic are beyond the scope of radium or surgery. The surgeon could distinguish these cases by opening the abdomen, but the radiologist was at a disadvantage and had to treat his cases without this additional information.

He compares his results with those of Heyman from Radiumhemmet at Stockholm, and with those of Ward from Woman's Hospital, New York. Both of the latter represented a series of unselected cases.

In a comparison of the cases seen, Bonney had a 25 per cent absolute cure, Heyman 22.7 per cent, and Ward 22.4 per cent. A direct comparison of cases treated, which was stated to be unfair to radium, showed Bonney to have a cure of 39.6 per cent, Heyman 23.8 per cent, and Gray Ward 23.1 per cent.

To make the results obtained by surgery and radium comparable, the patients treated by radium were divided into four groups. The first two were cases classified as operable, and their percentage was called the "radiological operability rate." This rate, however, bore no relation to the surgical operability rate and was always lower. On this basis, the results of such a comparison in Table II showed Bonney's cure-rate to be 39.6 per cent, Heyman's 40.8 per cent, and Ward's 53.1 per cent.

A comparison between Heyman's and Ward's Groups 1 and 2, and Bonney's cases without gland involvement was fairer, and this comparison in Table III showed Bonney to have a cure-rate of 51.3 per cent, Heyman 40.8 per cent, and Ward 53.1 per cent.

In the fourth comparison, the patients within the scope of each method of cure were decided as 60 per cent for Heyman and Ward, and 63 per cent for Bonney. From this, taking the five year survivals, the "scope cure" was determined and it was found to be 39.6 per cent for Bonney, 37.8 per cent for Heyman, and 37.7 per cent for Ward. This last table showed the cure-rate effected by radium on cases without glandular involvement was

about equal to the cure obtained by surgery on cases with involved and uninvolved glands.

In Table v, assuming that 40 per cent represented the cases of glandular involvement in all series, a comparison of the cases treated, which had gland involvement and those which did not, showed in the 60 per cent uninvolved cases that Bonney's cure-rate was 30.9 per cent, Heyman's 37.8 per cent, and Ward's 37.7 per cent; but in cases of gland involvement, which were assumed to be 40 per cent, Bonney's rate was 16 per cent while Heyman's and Ward's were both 0 per cent. This showed radium to be better in cases without gland involvement and surgery to be better in cases with gland involvement.

In his conclusion, the author points out that Heyman knew the results of all his cases. However, Bonney lost sight of 13 patients which he concluded had died. Also, many of Bonney's operations were done years ago when his operative mortality was not comparable with his mortality rate of today.

In the inoperable cases, it is true that a certain number of the 155 cases could have been cured with radium today.

The above statistics were based on results of surgery and results of radium used in the vagina only. Statistics on cases in which the two were combined were not available. A combination of the two would have the advantage of surgery to extirpate the regional glands, and radium to treat the local lesion. He contends that both should be combined.

The paper is followed by a discussion to which Bonney replies that surgery should be used to the limit of its possibilities, and then combine this with radium treatment, and in inoperable cases radium should be used.—*E. P. Pendergrass.*

Carling, Francis Rock. Radium teletherapy; experience with a temporary "bomb." *Brit. M. J.*, May 11, 1929, i, 845–848.

The author discusses at length the different types of treatment by radium. He has developed a method which he feels is of value. The presentation should be of interest to any one doing radium therapy with large amounts of radium, but a satisfactory abstract cannot be made.—*E. P. Pendergrass.*

Donaldson, Malcolm. Technique of intra-abdominal insertion of radium for carcinoma of the cervix uteri. *Brit. M. J.*, May 11, 1929, i, 844–845.

Early carcinoma of the cervix is readily destroyed by irradiation, but in widespread involvement of the pelvis there is great difficulty in controlling the malignancy. There are several explanations for this difference: (1) it may be the better blood supply that is found in the region of the deeper part of the growth; (2) it is possible that the resistance of the body materially helps radiotherapy in early cases, but that in the more advanced cases no such help is forthcoming; (3) the cells in late cases may be radioresistant, and (4) it is more difficult to apply an efficient dose to the more distant cells.

The author has developed a modified technique of that first used in the Radium Institute of Brussels, which is as follows: Radium is applied to the uterus by the cervical route. Six or eight weeks later an intra-abdominal insertion of radium is made. With the patient in the Trendelenburg position, the abdomen is opened and a general examination of all structures is made. The intestines are then packed away and the uterus pulled forward. The parietal peritoneum is picked up with forceps and the needle inserted up to the eye. It is then sutured in place and a knot tied over a glass bead to prevent cutting through the thin peritoneal tissue. The needles are placed 1 to 1.5 cm. apart, starting at one sacroiliac joint and ending at the other. In addition, four, or possibly more, needles are placed in front of the broad ligaments in the hope of preventing involvement of the obturator glands. The needles are allowed to remain in situ for seven days. Then the patient has another laparotomy and they are removed. (The author does not state the number of milligrams of radium element contained in each needle.)

Thirteen cases have been treated. Six were alive after five years and one lived four years; the others died.—*E. P. Pendergrass.*

Driver, J. R. Roentgen-ray treatment of the spine in lichen planus. *Arch. Dermat. & Syph.*, April, 1929, xix, 620–639.

The treatment of lichen planus by irradiation of the spinal cord and the sympathetic ganglions has developed many enthusiastic supporters in France. Moreover it has opened new fields for investigation and has stimulated considerable discussion regarding the possible neurologic origin of many dermatoses of unknown genesis.

Since 1924 lichen planus has been treated by the roentgen ray. Two methods have been reported, the semi-deep method of Pautrier and Hufschmidt, consisting of treatments over the spinal column which is divided into five fields from the first dorsal to the fifth lumbar segments, and the superficial method of Gouin which consists in giving a single dose of five Holzknecht units without filter,

perpendicularly over the spinous processes of the interscapular region (the principal sympathetic field). In some of Gouin's patients it was necessary also to treat the lower dorsal spine (accessory cutaneous field). Both methods have been used rather extensively in Europe, and particularly in France, often with slight modifications, with favorable results in general.

The author's roentgen dosage was computed according to the formula of MacKee, Remer and Witherbee, for determining the "standard erythema dose."

Technique. 1. Superficial method: Two midline exposures with the rays directed vertically were made, one interscapular at about the level of the second dorsal vertebra and the other dorsolumbar at the level of the second lumbar segment. The dosage varied between one-half and five-eighths of a standard erythema dose. The factors were 5 ma.; 6 inch spark gap (100 kv.); 10 inch anticathode skin distance. The time required for one-half erythema dose was fifty-seven seconds; for the five-eighth erythema dose, one minute, twelve seconds. The number of treatments in each case varied between one and three. The interval between treatments varied between two and four weeks.

2. Filtered method: The same areas, also the vertical application are used as in the unfiltered method. The factors were: 5 ma.; 7 inch spark gap (113 kv.); distance 10 inches; 3 mm. Al filter. The time required for one-half erythema dose filtered unit equaled five minutes, fifty-three seconds; for five-eighths erythema dose filtered unit it equaled seven minutes, twenty-one seconds. From one to three treatments at intervals of two to four weeks were used.

In order to better evaluate the method, no other local or internal remedies were used in any of the patients while under observation.

Conclusions. 1. Twelve of the 17 cases, or 70.6 per cent, were favorably influenced. Of these, 10, or 59 per cent, showed complete cures. These results compare favorably with those published by the majority of the investigators.

2. Patients with acute generalized lichen planus show the best response to this mode of therapy. The results are usually constant, and because of its simplicity, the method has many advantages over the more time-consuming one of direct roentgen therapy.

3. In patients with chronic generalized lichen planus, the effect is much more uncertain; one patient was cured and one was improved out of the 5 in this series, and therefore it can hardly compare with the more constant results obtainable by direct irradiation.

4. Encouraging results in acute and subacute localized hypertrophic lichen planus of the extremities lead the author to recommend this method, particularly if failure has resulted from direct roentgen therapy or the use of other measures.

5. In lichen planus of the mouth, the results are likely to be uncertain. The method is recommended when other measures fail.

6. Concerning the choice of methods, Driver believes that this study, while lacking sufficient proof, shows that, in general, the filtered method gives more promise of success. The dosage used in his study was somewhat less than that used by most investigators. The number of treatments given is more than that reported by some, and the time required to obtain a favorable result has been as a rule longer than that reported by Gouin and Pautrier. The method of smaller doses given on two fields only and repeated, if necessary, has the advantage of greater simplicity and avoids the dangers attendant on greater dosage over more surfaces.

7. Further investigations may ultimately produce the ideal technique, and give even better results.

8. Roentgen-ray treatment of the spine is, then, recommended as a procedure of definite proved value in the treatment of lichen planus and is especially indicated in the acute generalized type. It can be recommended in all other types of the disease in which the patients do not respond to other methods of treatment.—*R. S. Bromer.*

Fuhs, Herbert. Treatment of dermatoses with borderline rays. *Strahlentherapie*, June 5, 1929, xxxii, 704–710.

During the past few years 405 cases of 43 different skin conditions were irradiated by the author with borderline rays.

The apparatus is that of Siemens-Reiniger-Veifa with Siemens tube which permits the irradiation of an area of from 14 to 20 cm. diameter at a skin target distance of 8 to 15 cm. The quality of rays is expressed in aluminum half-value layer, while the amount of radiation is measured in R units. A dose of from 100 to 6000 R was applied in the different conditions, treatment being repeated every two to four weeks. It is interesting that although some marked erythemas were obtained, no ulceration such as observed following roentgen rays were seen even with the largest doses.

The results obtained are classified according to: (1) whether a general treatment was given, and (2) whether a treatment was of a local character.

(1) Twenty-six cases were treated with irradiation (acne vulgaris, 9 cases; acne rosacea, 11 cases; eczema, 5 cases; psoriasis vulgaris, 1 case), the results in all cases being of only temporary duration.

(2) The local irradiation in some forms of dermatoses has led to truly remarkable results. The following classification is given of the results in different skin conditions with regard to the dose applied (quality 0.0292 mm. Al half-value layer).

(*a*) Very good results: acne varioliformis (300–500 R); basal cell carcinoma (2000–4000 R); bubo ex ulcere molli (1500–2000 R); chronic eczema (100–600 R); erythema induratum Bazin (600–900 R); furunculosis (600–900 R); gumma (600–900 R); lymphogranulomatosis inguinalis (2000 R); morbus Darier (1000–2000 R); mycosis fungoides (500–1000 R); poikilodermia vascul. atroph. (1200–1800 R); psoriasis (300–900 R); sarcoma idiopath. multiplex (2000–3000 R); tuberculosis verrucosa cutis (2000–6000 R); verrucae planae (300–600 R); verricae vulgares (900–3000 R).

(*b*) Good results: bromoderma tuberosum (2000–4500 R); naevus flammeus (900–2000 R); lichen ruber planus (200–500 R); lupus vulgaris (600–6000 R); lymphogranulomatosis (Paltauf-Sternberg) (200–400 R); paronychia (600–1500 R); pityr. lichenoid. chron. (300–600 R); pemphigus benignus (200–600 R); scrofuloderma (1800–2000 R); sycosis (100–600 R); tuberculosis ulcerosa (1800–2000 R); trichophytia profunda (300–800 R); clavi plantares (1800–6000 R).

(*c*) No results: acne decalvans; acne rosacea; acne vulgaris; alopecia areata; angulus infectiosus; dermatitis papillaris cap.; congelatio; keloid; squamous cell carcinoma; papulonecrotic tuberculide; pruritus; scleroderma; ulcera cruris; urticaria chron. perstans.

The conclusion is reached that the application of the borderline rays forms an important addition to the present-day methods of treatment in different dermatoses.—*T. Leucutia.*

Fuhs, H., and Konrad, Josef. The treatment results with smallest radiation doses in skin diseases. *Strahlentherapie*, June 5, 1929, xxxii, 711–714.

The indirect irradiation through the spleen and liver gives practically no results in skin conditions.

The direct irradiation of the lesions by using very small doses (from 7 to 15 R) of roentgen rays of very superficial quality (0.1 to 0.14 mm. Cu; at a skin target distance of 20 to 40 cm. and repeated at two weekly intervals) according to the indications of Thedering proved of considerable value. Since the method leads to excellent cosmetic results it is advocated that it be tried in all instances before resorting to more severe radiations.—*T. Leucutia.*

Gál, Felix. The treatment of uterine bleeding by irradiation of the spleen. *Strahlentherapie*, June 5, 1929, xxxii, 695–703.

Twenty-six cases of different uterine bleedings (18 virgins and 7 married women) have been treated during the past four years by irradiation of the spleen.

The dose applied was ⅓ to ¾ S.U.D., Symmetry apparatus, 43 cm. spark gap, Coolidge tube, 0.5 mm. Zn plus 2 mm. Al, 25 cm. skin target distance. Sixteen cases were irradiated once, 19 cases twice and one case four times.

The immediate effect was good. In 13 cases which were hospitalized the menses ceased within one to five days following the irradiation. Only 14 cases were observed for a period of from one to three years. Of these, in 5 menstruation later continued normally, while in the others there was recurrence of the symptoms.

The conclusion is reached that irradiation of the spleen in uterine bleedings has an immediate value but that it is not a method leading to permanent results. Therefore it should be applied only as preparatory to surgical intervention (curettage, etc.).—*T. Leucutia.*

Gordon-Watson, Charles. The treatment of cancer of the rectum with radium. *Brit. M. J.*, April 13, 1929, i, 671–673.

While great strides have been made in the operative treatment of carcinoma of the rectum during the past ten years, unfortunately when most patients apply for treatment, the condition is usually inoperable. As in early malignancy elsewhere, surgery offers the best and most certain promise of cure.

With increased experience, radium therapy is rapidly increasing the percentage of cures in inoperable carcinoma of the rectum. The management of such a case consists of exposure of the growth through the perineum and the implantation of radium needles or radon seeds, so that each cubic centimeter of growth receives not less than 1 mg. of radium. At the same time, needles or seeds are implanted along the lymphatics of the superior, middle, and inferior hemorrhoidal vessels. After the introduction of radium, a colostomy is performed, but this is not opened until the radium needles are removed, which is usually after about ten days, 30 to 60 mg. of radium having been used. In the case of seeds, which do not

require removal, the colostomy may be opened at any time. The perineal wound is packed with flavine gauze and kept moist by the Carrel-Dakin method, the skin wound being temporarily closed until the radium is removed. Occasionally, as a supplement, 50 mg. of radium, heavily screened by platinum is placed in the slot of a solid lead rod enclosed in rubber tubing, and this is inserted into the lumen of the rectum.

In the case of high rectal growths, the needles are implanted in the tumor and along the lymphatics, intra-abdominally, at the time the colostomy is performed. In low growths, no special operative procedure is required for the implantation. In women, the radium may be implanted, in suitable cases, per vaginam.

The author has treated 30 cases in the above manner with some very encouraging results. It is possible by irradiation at times to render an inoperable case operable. Recurrences are best treated by radium, using needles combined with external irradiation on Columbia paste.

In comparing the relative values of surgery and irradiation, the author states that until we can predict with a fair degree of accuracy the result to be obtained from a given dose of radium, surgery, mutilating as it is, must be given the preference in operable cases. In the inoperable cases, however, radium holds out a great prospect of cure. And even in the early cases, he expresses the opinion that it is quite possible the time may not be so far distant when irradiation will offer as high a percentage of cure as operation, and with less risk, and in a certain number of cases, without the inconvenience of colostomy.—*Karl Kornblum.*

Grauer, Sepp. The use of the heavy metal filter in the roentgen treatment of chronic eczema. *Strahlentherapie*, June 5, 1929, xxxii, 715–720.

Two hundred cases of chronic eczema were treated by applying roentgen rays filtered through a heavy metal filter. In some of the cases which were more or less symmetrical, half of the body was treated by light filters (2 mm. Al) and the other half with heavy filters (0.36 mm. Zn and 2 mm. Al), and it was found that in all instances the irradiation through heavy filter led to better results. As a rule, three surface doses of 4 H are given at 30 cm. skin target distance and with 4 ma.

The reaction is considerably less and the cosmetic results are more satisfactory.—*T. Leucutia.*

Keene, Floyd E., and Block, Frank B. The treatment of uterine fibromyomas (series 1925–1927). *Am. J. Obst. & Gynec.*, June, 1929, xvii, 848–854.

In a previous report the treatment of uterine fibromyomas as employed in the Department of Gynecology at the University of Pennsylvania was analyzed for the three year period from 1922 to 1924 inclusive. The present paper comprises an analysis of a similar series of cases which were treated from January 1, 1925 to July 1, 1927. The authors' purpose in analyzing the second series was to determine whether they were closely following the recommendations previously outlined, and to obtain a careful check-up of their work.

During the second period, 1925–1927, 259 cases were treated, of which 161 (62.1 per cent) were operated upon and 98 (37.9 per cent) were irradiated. This is almost identical with the earlier series in which 63.2 per cent were operated upon and 26.8 per cent were irradiated. However, in summarizing the cases by separate years the percentage of cases irradiated has shown a steady decline, being 44.7 per cent in 1925, 37.3 per cent in 1926 and 27.5 per cent in 1927. The authors believe that radium when properly indicated is a very valuable therapeutic measure, but when contraindicated, or even when in doubt as to its proper indication, it should not be used, as it is a two-edged weapon and has as great potentialities for harm as for good in improperly selected cases. Roentgen irradiation was employed only four times in the second series and its use was confined to patients whose general condition would not permit of operation with any degree of safety and whose tumor was much too large for radium irradiation.

Surgical Treatment. Complicating pelvic lesions were present in 47 per cent of the cases operated upon, and in 25 per cent of the cases pelvic inflammatory disease was the complicating factor. The other complications noted were perforating cysts of the ovary, other types of ovarian cyst, carcinoma of the ovary, carcinoma of the uterus and pregnancy. The high incidence of complications serves to emphasize the care which must be used in excluding such cases from radiation therapy and justifies the dictum "when in doubt, operate." The various types of operation are discussed, vaginal or abdominal, myomectomy, or complete or subtotal hysterectomy. Supravaginal operation was performed in 86.4 per cent of the cases as opposed to panhysterectomy which was employed in only 2.4 per cent. In all the operative cases a policy of ovarian conservation was followed whenever healthy

ovarian tissue was present. In 20.4 per cent of the operative cases there were postoperative complications.

Irradiation Treatment. In the series, 94 patients were subjected to radium irradiation of whom 85 (90.4 per cent) were over forty-one years old. Of the 94 cases, 74 received irradiation alone, and 20 had some plastic operation at the time radium was used. Of the 74 patients, 57 were traced of whom 94.7 per cent were cured. In the combined series, 1922–1927, 247 cases were irradiated, and a cure was obtained in 91.3 per cent, secondary operation was required in 5.4 per cent, and the mortality was 0.4 per cent. The follow-up study revealed the interesting fact that while metrorrhagia and menorrhagia were almost always relieved in both operative and irradiation cases, leucorrhea was unrelieved in 29 per cent of the operative group and in 36 per cent of the irradiation group. Pain was unrelieved in 24 per cent and bladder symptoms in 9 per cent of the operative group. In about 50 per cent of the cases there has been an increase in weight following irradiation. Four cases were subjected to roentgen irradiation with apparently satisfactory results.

Mortality. In the combined series, the mortality in 518 uncomplicated cases was 0.39 per cent which was equally distributed between the operative and the irradiated groups, whereas in 163 complicated cases the mortality rose to 4.9 per cent or 12 times as great. In 681 cases of all types the mortality was 1.46 per cent. The mortality is thus almost entirely the mortality of complicating disease.

Conclusions. The authors believe the following conclusions are justified:

1. The mortality in the treatment of uterine myomas when uncomplicated by other pelvic disease should be below 1 per cent whether the case is treated by operation or irradiation.

2. The mortality in the treatment of uterine myomas complicated by other pelvic lesions will depend largely on the type of complicating disease but in any event will be materially higher than that of the uncomplicated cases.

3. Irradiation is the treatment of choice in about one-third of all cases of uterine myomas requiring treatment, but it is of great importance to select the cases carefully, and it is well to remember that "when in doubt, operate."

4. In the operative treatment supravaginal hysterectomy is the operation of choice in the large majority of cases. Abdominal and vaginal myomectomy are useful operations in selected cases, but panhysterectomy is only occasionally to be performed.

5. Ovarian conservation is always to be practised when healthy ovarian tissue can be retained without interference with its blood supply.

6. Bleeding will be relieved in practically all cases operated upon and in about 95 per cent of the cases irradiated, but leucorrhea will persist in about one-third of the cases after either method of treatment.

7. Almost half of the myomas subjected to operation are complicated by other pelvic lesions.—*R. S. Bromer.*

Laws, George M. Results of x-ray therapy in myoma and other nonmalignant lesions of the uterus. *Am. J. Obst. & Gynec.*, June, 1929, xvii, 855–860.

Laws reports results of roentgen therapy in uterine myoma and other nonmalignant lesions of the uterus from the gynecologic service of the Presbyterian Hospital, Philadelphia. In the period from 1922 to 1927, 94 cases were referred to the roentgenological laboratory for treatment. All were treated by a uniform technique described by Dr. W. S. Newcomet, the radiologist of the hospital, as follows: Four areas over the anterior portions of the pelvis, each 2 inches square, are exposed for four minutes, 10 inch distance, to rays produced by a current of 4 ma., 8 inch spark gap and filtered by 3 mm. of aluminum. If a second treatment is given, five similar posterior areas are exposed. In brief, it consists of small doses of roentgen rays, repeated if need be, at intervals of six weeks. In urgent cases it has been repeated in four weeks.

This roentgen treatment was usually prescribed by the gynecologic staff as a symptomatic remedy for bleeding where it was applicable and was discontinued when the effect was secured. Occasionally it was given again at a later date. The treatment caused no local symptoms, and there were rarely any perceptible skin changes. No roentgen sickness was observed.

The paper is illustrated by tables showing the results in the various conditions for which the treatment was prescribed, the contraindications to operation and to radium, and the indications for roentgen therapy.

Myomas. In women with clinical evidence of a myoma, under forty years of age, the desired control of menorrhagia was usually accomplished. No patient under forty had a permanent menopause from the treatment. In older women without bleeding, roentgen therapy was tried occasionally for the relief of pressure symptoms. In this series of 4 cases, all obtained relief of symptoms, but 2 showed

no decrease in the size of the tumor. Submucous fibroids did not respond satisfactorily to treatment. In a group of 8 cases showing ideal indications for radium treatment but which were treated by roentgen rays, the results compare favorably with radium therapy in a similar group, although bleeding was not controlled as promptly.

Functional Hemorrhage. Thirty cases variously diagnosed myopathic, fibrosis, hyperplasia, menorrhagia, etc., were analyzed from the standpoint of clinical findings and laboratory reports of the curettings. The study proved of no value as a guide to results to be expected from the roentgen ray. It strengthened the opinion that the lesion is really ovarian. The failures were in the young women. The results in the remainder were not always ideal but no known patient under forty years of age had a permanent menopause as this result was not desired. Some were carried along with occasional treatments to control bleeding. Roentgen therapy was avoided, as a rule, in women who were likely to become pregnant. None of the cases is known to have developed malignancy.

Postoperative Inflammatory Cases. Five patients who had menorrhagia or metrorrhagia after conservative operations responded favorably to treatment.

Two cases of post-climacteric hemorrhage were treated. One of these had persistent bleeding after a negative diagnostic curettage, which ceased after two roentgen treatments. One case with dysmenorrhea with associated nervous manifestations showed temporary amenorrhea with improvement of symptoms which led to repetition of treatments totaling nine in four years. A stimulating dose of the roentgen ray, smaller than the standard dose, was employed in 2 cases of amenorrhea of one year's duration. One patient menstruated three months later, and the other failed to show any result from the treatment.

Laws concludes that it is of real value to a gynecologic service to have roentgen-ray treatments given by a standard dosage until sufficient experience is obtained to prescribe a more ideal individual treatment. The small dosage which he reports in his series of cases has enabled the gynecologic staff to extend the field of roentgen therapy so that an increasing number of women are referred for treatment each year. The patient is not restricted in her activities except by hospitalization for curettage which is usually indicated. Roentgen therapy thus has one important advantage over radium therapy, particularly if small doses are used and must be repeated. If radium is not at hand at the time of curettage, it is less disturbing to apply roentgen rays later, after the pathological report is obtained. The contraindications to small roentgen dosage are few and are practically confined to its effect on ovary and fetus.—*R. S. Bromer.*

Murphy, Douglas P. Ovarian irradiation and the health of the subsequent child: A review of more than two hundred previously unreported pregnancies in women subjected to pelvic irradiation. *Surg., Gynec. & Obst.*, June, 1929, xlviii, 766–779.

In Murphy's first publication, 1928, he reviewed the literature which dealt with the health of all children reported as born following maternal pelvic irradiation. In his present study the health of another group of children, born of irradiated mothers has been analyzed. These two publications, when combined, will represent the largest collection of reported cases available dealing with the possible relation between maternal pelvic irradiation and the health of subsequent children.

This information was secured by a questionnaire sent to leading gynecologists and radiologists throughout the United States. To these have been added several reports of pregnancies which appeared in the current literature since it was recently reviewed, and a number of pregnancies previously reported by one author (17) which were unintentionally omitted from the first communication.

This paper is of extreme importance and interest to radiologists and should be read in its complete form as the numerous illuminating tables and the very detailed analyses cannot receive full justice in a brief abstract. For convenience of presentation the material is presented by the author under the following five headings.

1. The health of the irradiated woman before treatment.
2. Factors concerned with the technique of treatment.
3. The effect of irradiation upon subsequent fertility.
4. The influence of the treatment upon the abortion rate.
5. The relation of the irradiation to the health of the subsequent children.

Eighty-five of 131 patients were treated for functional hemorrhage apparently not associated with any gross pelvic lesion. It is difficult to evaluate the influence of maternal irradiation as practically nothing appears to be known concerning the relation that may exist between local disturbances of the

pelvis, such as functional uterine hemorrhage, and the future health and development of the subsequent offspring.

The most striking point brought out by the study of the table showing the sources of radiant energy used is the fact that pregnancy should take place after so long an exposure of radium as 1800 milligram-hours, when permanent sterility is known not infrequently to follow pelvic radium treatments in which little more than one-third of that amount was administered. Radium and the roentgen ray were used with about equal frequency, and from a study of the end-results, their effects appear to have been identical.

From Murphy's analysis it would seem that maternal irradiation has no effect in increasing the abortion rate. When the irradiation takes place during pregnancy the abortion rate in the collected cases was approximately 43.3 per cent (23 abortions in 53 pregnancies). In the 230 cases where the treatment preceded pregnancy, there were approximately only 50 abortions, a rate of but 21 per cent. Thus when the time element of treatment is considered, a variation of the abortion rate is found.

In regard to the effect of irradiation upon subsequent fertility, it would seem that the interval of time between treatment and birth appears to lengthen as the amount of radium exposure increases from 200 to 500 mg-hr., whereas beyond the 500 mg-hr. point no constant relation between the two seems to exist.

Of 233 full-term children, 37, or approximately 15.4 per cent, at some time while under observation presented evidences of defective health or of under-development. Unhealthy children were considered those who were born at or close to term and who presented at any time while under observation any disease or defect, mental or physical, or who died from any cause while under observation. The greater number of children were under observation for only about four months, although several were observed for periods as long as seventeen years. Of the 53 women who received postconception irradiation, 23 aborted and the remaining 30 who went to term, all bore unhealthy children, according to the definition arbitrarily determined upon for the purposes of this study. In the majority of these cases the treatments were given by means of the roentgen ray. Most of the pregnancies were unsuspected at the time of treatment. The children were under observation for a long enough period of time, and the nature and seriousness of their disturbances were such as to indicate plainly the existence of impaired health or defective development.

As was shown in Murphy's previous review of the literature, irradiation of the developing embryo, whether human or animal, is extremely likely to end disastrously, while in both cases the damage most frequently found was observed in the central nervous system. In the group of unhealthy children reported upon in this present paper, underweight at birth, microcephaly, blindness, hydrocephalus, Mongolian idiocy, and other gross defects of structure and function were observed, the majority of them involving the central nervous system.

From a study of the table showing the influence of the time of treatment, postconception irradiation, upon pregnancy and the health of the children born at term, 13 of the pregnancies ended normally (approximately 50 per cent). Of the pregnancies ending abnormally, most of them occurred following irradiation, taking place prior to the fourth month. However the appearance in one case of a microcephalic idiot following irradiation as late as the sixth month points to the possibility of damage to offspring when radiation therapy is practised at that period in the life of the fetus. Of the cases receiving preconception irradiation, abortion took place in 21.7 per cent. Of the cases that went to term, 15 per cent of the children might be classed as unhealthy. This should be contrasted with the 40 per cent in those cases receiving postconception irradiation. There was an absence of microcephaly in the preconception cases, and in many cases the disturbances were not serious, and most of them could be explained on grounds other than maternal irradiation. All the disturbances of this group appear among the non-irradiated part of the population, hence none can be regarded as pathognomonic of irradiation damage. The tables also show that there is no increase in the infant death rate that might be attributed to maternal irradiation.

Conclusions. If the foregoing theories, namely, first, that postconception pelvic irradiation may seriously injure the health and development of the child *in utero*, and second, that preconception ovarian irradiation is not detrimental to the health and development of subsequent offspring, are correct, what practical bearing have such conclusions upon the future use of radium and the roentgen ray in the treatment of pelvic lesions in women of the child bearing age?

The first practical bearing is that postconception irradiation should not be employed during pregnancy if the child *in utero* is to be allowed to go to term, for there is a 40 per cent likelihood that the child will present some

serious defect as a result. The second important conclusion drawn is that before radiation treatment is undertaken, it should be ascertained definitely whether any woman about to receive such treatment is or is not pregnant. In order to obviate the possibility of pregnancy, which might go on to term despite the manipulation or other procedures incident to the irradiation, the uterus should be curetted. This is a further check against the existence of carcinoma of the fundus, a condition apparently overlooked in a high percentage of cases. In view of the findings in this and the previous paper, it would seem that such care ought to be exercised in order to eliminate the possibility of irradiating an unsuspected living embryo.—*R. S. Bromer.*

Rentschler, Calvin B. Primary epithelioma of the vulva; an analysis of seventy one cases. *Ann. Surg.*, May, 1929, lxxxix, 709–730.

An analysis of 71 cases of primary epithelioma of the vulva from the records of the Mayo Clinic from 1907 to 1927 is presented. The condition is rare, its ratio to carcinoma of the cervix being 1:25. While it may occur at any age it is distinctly a disease of old age, the majority of cases occurring after sixty. Chronic irritation, especially pruritus, is considered as a significant etiological factor. The labia majora are most frequently involved, the left as often as the right.

In the symptomatology, itching is probably the outstanding single symptom. Along with this are pain, discharge, slight bleeding, and later insomnia, secondary anemia, cachexia, and urinary complaints. Many patients seek medical advice because of the discovery of a tumor which in 47.5 per cent of the cases reported showed ulceration when first examined.

The importance of early diagnosis and the need for careful and repeated examinations in patients complaining of pruritus is stressed. Among the conditions to be differentiated from epithelioma of the vulva are metastatic lesions from primary tumors elsewhere, especially in the genital tract, tuberculosis, chancre, chancroid, urethral caruncle, chronic infections of Bartholin glands, leucoplakia and benign papilloma.

Pathologically the lesion may be of the superficial vegetative type or it may be of the deep infiltrative type. The majority of lesions are of average malignancy as determined by Broder's classification.

A review of the lymphatics of the vulva with drainage path-ways to the inguinal and pelvic lymphatics is given. On the basis of this it is seen that metastasis is first to the inguinal nodes, with the exception of lesions of the clitoris, the lymphatics of which pass directly to the pelvic nodes. Lymphatic extension is also possible to the opposite inguinal region. The inguinal lymph nodes may be palpable either from hyperplasia or metastatic involvement. Nodes that are not palpable may also contain malignant cells. Microscopic study of these nodes is the only absolute criterion of their involvement. Distant metastasis also occurs, especially to the lungs.

In the treatment surgery followed by radium and roentgen irradiation is the method of choice. Wide excision of the local lesion with removal of the regional lymph nodes on both sides is advocated where the case is operable unless biopsy has shown a lesion of grade 3 or 4. In these more malignant cases the treatment should consist of local excision of the lesion, supplemented by radium and roentgen therapy over the site of the original growth and lymphatic drainage. In the inoperable cases, obvious lymphatic involvement associated with grade 3 or 4 malignancy, irradiation alone should be resorted to.

In this series 45 patients died, all but one from carcinoma. Seventeen patients are still living, 13 free from recurrence after an average duration of 7.73 years. From this study it is concluded that the prognosis is fair for prolongation of life, but poor for cure and would seem to be in direct proportion to the grade of malignancy.—*Karl Kornblum.*

Robinson, G. Allen. Radium therapy in diseases of the eye and adnexa. *Arch. Opbth.*, May, 1929, i, 583–589.

The author employs in the radium treatment of vernal catarrh, an unscreened 5 mg. radium plaque; in epithelioma of the eyelids, gold filtered radon implants or small radium needles which are applied interstitially, or surface applications are made. In irradiation of the orbit, a radium pack of a few hundred milligrams is applied at a distance of 3 to 6 cm.

The technique for the treatment of vernal catarrh is as follows: After cocainization, the eyelids are inverted and retracted. An application of a 5 mg. radium plaque is made for a period of ten minutes at intervals of seventeen to fourteen days. Within two or three days after the initial treatment, the patient notes an improvement in the condition of the eyes. The pain is less, the scratchy feeling disappears, the secretions decrease, and the photophobia is less marked. The cobblestone lesions appear to soften, become flattened and gradually disappear. A total dose of 300 to 600 mg-min. is required in the

treatment of these lesions. Some are stubborn and others disappear quickly. Surgical removal or desiccation previous to irradiation would probably hasten the end-result.

Robinson's personal experience with trachoma of the eyelids has been too meager to quote results. Some benefits have been obtained in 4 cases. For rodent ulcers of the eyelids four 10 mg. platinum radium needles are implanted into the base of the growth for two hours. Gamma rays are applied to the surface of the growth and the surrounding tissues for 300 mg-hr. He has also treated a plexiform neurofibroma of the upper lid. After three plastic operations followed by radium, the growth has not returned for an interval of approximately three years and three months after the first operation and application of radium. One case of a vascular tumor of the upper lid, a perithelioma, has not returned in five years. Papillomas of the lid respond to treatments with radium, resulting in little deformity and scant loss of eyelashes. Pigmented moles are resistant to treatment, and should be surgically removed or treated with electrodesiccation. Melanomas of the eyelids require caustic doses of radiation for their destruction and electrodesiccation should be employed. Keloids of the lids yield to radium therapy. Dense firm scars however are radioresistant. For these excision followed by radium treatment is suggested.

The author has applied radium to the orbit for the following conditions: Melanoma (4 cases), glioma (7 cases), carcinoma (7 cases), and sarcoma (6 cases). Of the 6 patients treated for sarcoma, one with an angiosarcoma is well ten years after operation and radium treatment, one with lymphosarcoma, and one with a perithelioma are well after an interval of five years.

Five cases of epibulbar carcinoma have been treated; one patient is well after five years, two after four years, one after two years, and one after eight months. Radium has also been used as a postoperative treatment for pigmented moles of the cornea.—*R. S. Bromer.*

Schreiner, Bernard F., A clinical study of eight cases of myoma malignum. *Surg., Gynec. & Obst.*, June, 1929, xlviii, 730–732.

The author's study of his 8 reported cases of malignant myoma of the uterus reveals four important facts: (*a*) that they occur in any decade, (*b*) that in an analysis of the symptomatology there are no pathognomonic symptoms of the disease; (*c*) that the operative treatment as it was carried out in the 8 cases was inadequate, which was demonstrated by the recurrences after intervals of time after operation, and (*d*) that the surgeons, in general, should heed and act upon the laboratory reports of suspected or definitely proved malignant myoma and insist on thorough irradiation as soon after operative interference as the healing of the wound will permit.

Schreiner concludes from his statistics that malignant myoma of the uterus occurs in six-tenths of one per cent of all uterine tumors examined. Of the 8 cases reported, one is clinically well after four years and nine months. In this case radiation treatment was used one month after operation. The end-results of the other 7 cases have been poor. In a few instances palliative results were obtained. Death in myoma malignum is caused by direct extension and by metastases. All fibroids should be examined microscopically, and if a suspicion of malignancy is found such patients should be subjected to postoperative irradiation immediately.—*R. S. Bromer.*

Skeer, Jacob. Sclerema neonatorum; report of a cure by x-ray therapy. *Arch. Dermat. & Syph.*, May, 1929, xix, 732–736.

Skeer reports a case of sclerema neonatorum because it is a rare disease and because in a search of all available literature he could not find a report either of the use of roentgen therapy, or of a cure by roentgen therapy in this disease. The case history is given in detail. The patient was referred to the roentgen laboratory for examination of the entire body in order to rule out the possibility of myositis ossificans. There was some misunderstanding in the laboratory and the patient was given roentgen therapy. Improvement was noted and further treatments were given at approximately three weeks' intervals. Roentgen examination showed no evidence of myositis ossificans. Irradiation was given at a distance of 10 in., for 60 sec., with 5 ma. and a 7 in. spark gap over the back, buttocks, dorsum of the thighs and calves. When seen after an interval of approximately six months the patient was considered cured.

In commenting on the case, Skeer gives a brief review of the literature on the pathogenesis of the disease. Numerous hypotheses have been advanced as to what is the nature of the fat changes in the corium and the hypoderm. In these layers the connective tissue is contracted and the adipose tissue contains an abundance of fatty acid crystals. Gray found a marked thickening of the trabeculae between the lobules. Masses of fibroblastic cells, numerous giant cells, groups of lymphocytes and a few leucocytes could be seen invading the surrounding fat lobules

and between the fat cells. The spaces of some of the empty fat cells appeared to be bridged across by strands of protoplasm, leaving narrow clefts between the strands which contained acidular crystals. Most of the authors agree that certain changes take place in the fat, but what actually causes these changes is an open question and will have to be investigated further.

It is difficult to explain just what action the rays have on the tissues. Numerous investigators have shown that radiations act on the higher fatty acids. Others have tried to prove that the radiations activate the autolytic enzymes. It is possible that radiations activate the enzymes so that a molecular change is brought about in the fat cells, causing the fat to undergo resorption.—*R. S. Bromer.*

Souttar, H. S. Radium and its surgical applications. *Brit. M. J.*, March 23, 1929, i, 538–542.

This is a résumé covering the discovery of radium, facts concerning its derivation and disintegration, apparatus and methods of clinical application and results in the treatment of malignant disease.

The discovery of radium by Madame Curie in 1898 revolutionized our conception of the atom especially as to the possibility of the decay of an element in the process of which it is transformed into another substance. We are indebted to Rutherford for the modern conception of the atom as a solar system consisting of a nucleus made up of protons positively charged and electrons, negatively charged. Around this nucleus revolve electrons each in its own orbit. Hydrogen is the simplest of all atoms, a single proton as nucleus with a single electron flying around it. The helium atom is next, four protons and two electrons as a nucleus with two electrons in the planetary system. In contrast is radium, a complex atom, having a nucleus of 226 protons and 138 electrons and 88 electrons whirling about the nucleus.

For the measurement of the size of a substance as small as the atom we have a new unit of measurement, the Ångström unit; symbol A. U. This is one hundred millionth of a centimeter. The wave lengths of roentgen rays vary from 12 A. U. to 0.5 A. U.; gamma rays 1 A. U. to 0.04 A. U. The diameter of the nucleus of an atom is $\frac{1}{25000}$ A. U.

Radium is a derivative of uranium. The disintegration of radium results successively in radon, radium A, B, C, D, E, polonium and lead. The half-value periods for these disintegration changes are given, for radium it is 1750 years and radon 3.85 days.

In the transformation of radium into radon an alpha particle is given off. This alpha particle is identical with the nucleus of the helium atom having four protons and two electrons. Radon is a gas and can be collected into glass or metal tubes and sealed. These tubes can be implanted directly into malignant tissue and because radon has a half-value period of decay of only 3.85 days such tubes need not be subsequently removed and the patient need not be hospitalized. The monetary value of these tubes is negligible. The essential difference between the use of radon and the element radium is the fact that in the former there is a uniform diminution in radiation. This can be offset by starting with a higher initial dose.

In the further disintegration radium B gives off a beta particle and with its liberation is bound up the production of gamma rays. Thus we have the alpha, beta and gamma rays that are utilized in therapy. The alpha rays consist of particles all positively charged. These have little power of penetration and therefore have no value in surgery. The beta rays are formed by electrons and therefore carry a negative charge. Their penetrative power is only slightly more than the alpha rays, being stopped by 0.3 mm. of platinum or by a centimeter of body tissues. Their effect is purely local and usually it is best to eliminate this effect by the use of filters. The gamma rays are ether waves set up apparently by the discharge of the beta particles. Their penetrative power is so great that they can pass through several inches of lead. They are reduced only 50 per cent in passing through 4 inches of body tissue. These rays have two important effects: they stimulate the activity of the tissue cells, especially the production of fibroblasts and they have a definite selective action on tumor cells.

In the surgical application of radium either the element in needles or glass or metal seeds containing radon are employed. To the eye of the needle stout silk thread is applied to prevent their loss and also to assist in their removal. The seeds are implanted in the tissue by means of special applicators. The needles and seeds may also be applied externally and for this purpose moulds of Columbia paste are very convenient.

As to dosage, the empirical observation that the gamma radiation from a milligram of radium can in a period of about five days destroy the cancer cells in a cubic centimeter of tissue is utilized. As an example of the

use of radium needles the arrangement devised by Keynes at St. Bartholmew's Hospital for the treatment of breast tumors is cited. In this treatment needles are inserted into and beneath the tumor, into the borders of the two pectoral muscles, into the axilla, infra- and supraclavicular spaces, into the upper five intercostal spaces and sheath of rectus. In all, forty to fifty needles are used, representing a total amount of radium of 75 to 100 mg. The needles are left in place for seven to nine days.

Lesions of the tongue are treated in a somewhat similar manner, using radon seeds for implantation. In most cases the tumor will disappear by magic and three weeks later it will have been replaced by a contracting scar. Following this the glands of the neck are dissected out on both sides. Three weeks later, treatment is completed by the external application of radium, using a thick wax collar made of Columbia paste.

The constituents of Columbia paste are given and the method for its use is outlined.

The method of the use of the "radium bomb" as devised by Dr. Cheval of Brussels is described. Four grams of radium are used and two patients can be treated at one time. The author states that the method is costly and very extravagant of radiation, but the results are said to be extremely good.

To illustrate the clinical results of treatment by radium the author describes a few of his own cases in which, apparently, cures were obtained, though the permanency of such cures is not vouched for. In these patients, the ordinary methods of surgery were not applicable. The cases described are carcinoma of the palate, epithelioma of the lip, carcinoma of the thyroid, carcinoma of the esophagus, carcinoma of the stomach and angioma of the meninges.

The author closes by stating, "It has rather been my aim to show how wide are the powers of radium, and that where we have failed it is rather our method of application than our weapon itself which is at fault. I am convinced that we are only on the threshold of a great adventure; I feel that a new world of surgical technique is opening before us; I am beginning to believe that at last we hold in our hands the key to the cure of cancer."—*Karl Kornblum.*

Strachan, Gilbert I. The treatment of carcinoma of the cervix with radium. *Brit. M. J.*, May 11, 1929, i, 842–844.

The author reviews briefly the action of radium, and discusses thoroughly the requisites of a preliminary examination of the patient about to be treated. The technique of the application of the radium by the vaginal route is discussed. The dosage may vary considerably, depending entirely on the size of the lesion, but the average is usually from 3000 to 3600 mg-hr. Daily vaginal douches are given to prevent stenosis of the cervix. One hundred and fifty-three cases have been treated since 1922; 40 are alive, 113 are dead.—*E. P. Pendergrass.*